ELECTRICAL TIMES

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FMmP PREPAYMENT METER

For optional or single coin use

The Ferranti FMmP Prepayment Meter is now available for operation with :-

- Shillings only, or
- Two-shilling pieces only, or
- Shillings or Two-shilling pieces at consumers option.

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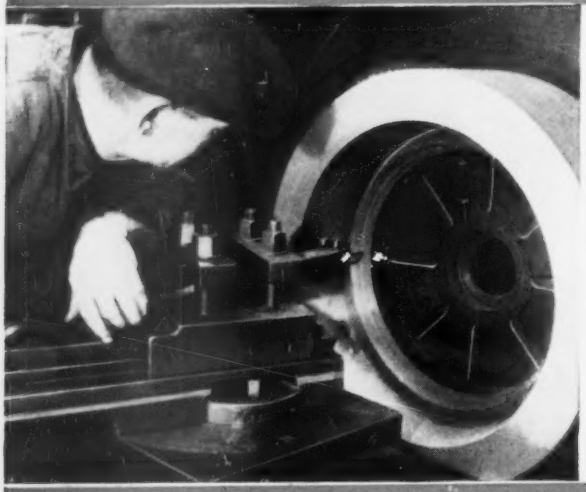
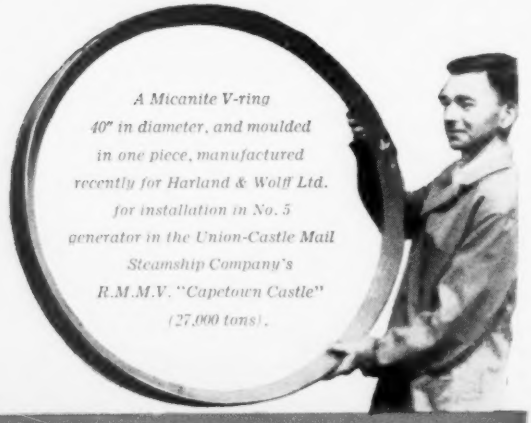
FM 130 4

We go from this... ○

to any size you like

M & I have the largest stock of Micanite V-ring moulds in Europe. Many different types are available in a very wide range of sizes. We have supplied Micanite insulation for commutator V-rings up to 114" in diameter but this is not the limit of our capacity. If you have any problems, please take us into your confidence — we have a wealth of experience gained over more than half a century. Let us have your enquiries for V-rings.





A Micanite V-ring 40" in diameter, and moulded in one piece, manufactured recently for Harland & Wolff Ltd. for installation in No. 5 generator in the Union-Castle Mail Steamship Company's R.M.M.V. "Capetown Castle" (27,000 tons).

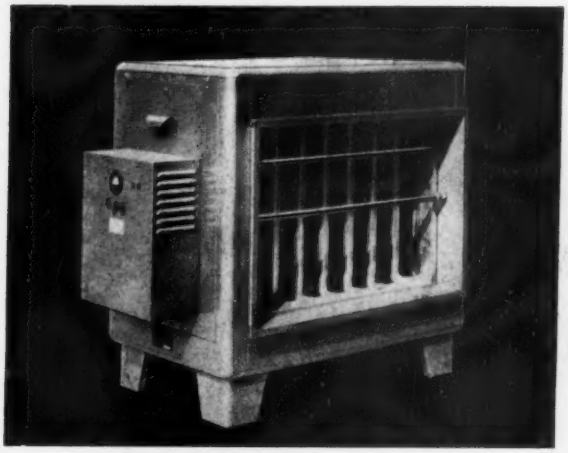
Moulds for V-rings are machined in our own factory.

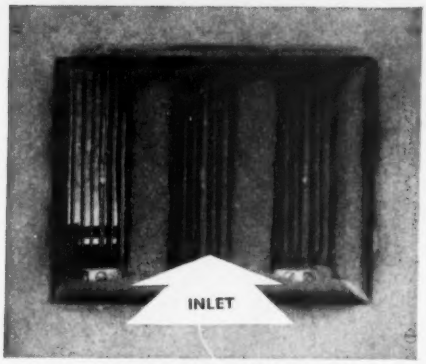
We make every type of Micanite Insulation and, as with all M & I Products, the quality is second to none.

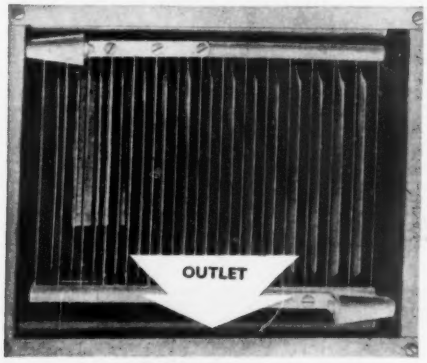
m and i **the electrical insulation people**

THE MICANITE AND INSULATORS CO., LTD.,

Blackhorse Lane, Walthamstow, London, E.17. Tel: Larkswood 5500.
Grams: "Mytilite", London, Telex. Telex: 25183.







Unretouched views of inlet and outlet of Trion after ten weeks continuous operation. This unit protects an electrical relay system.

Protect your electrical equipment— install TRION Electronic Air Filters

The extremely high efficiency of the Trion Electronic Air Filter, 90% Photometric Basis (99·5% on a weight basis), ensures that electric motors, switchgear and sensitive instruments are given adequate protection against the troublesome mass of small particles which can be the major cause of expensive breakdowns.

This extremely high efficiency does not mean that the Trion Electronic Air Filter is more expensive than other types of filter having much lower efficiencies. The initial cost is attractive, maintenance costs are negligible, expensive replacements unnecessary and power consumption exceptionally low.

Capacities of United Kingdom installations range from 250 c.f.m. to 200,000 c.f.m.

For full details please write for Publication No. 67/49

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TRION UK

Industrial Applications:

W. C. HOLMES & CO. LTD.

Gas Cleaning Division

TURNBRIDGE, HUDDERSFIELD Telephone Huddersfield 5280

Commercial Applications HARRIS ENGINEERING CO. LTD. York Works, Browning St., London, S.E.17

A

SOFONO ELECTRIC
SPACEMASTER
REFLECTOR/CONVECTOR
from
£8.18.7
retail

the SPACE AGE
range of

SOFONO

ELECTRIC HEATERS

Daring . . . different . . . SOFONO sweep into the electrical field with a range years ahead of their time. Here are four basic models . . . and a host of added refinements including thermostats, half-heat economy switches and a wall-mounting kit for the 1 kw adjustable angle reflector fire. All available in 1 kw and 2 kw models, and a range of 'House & Garden' colours :— Mocha, Flame, Clover Pink, Cloud Grey and Gunmetal.

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from
£6.12.6
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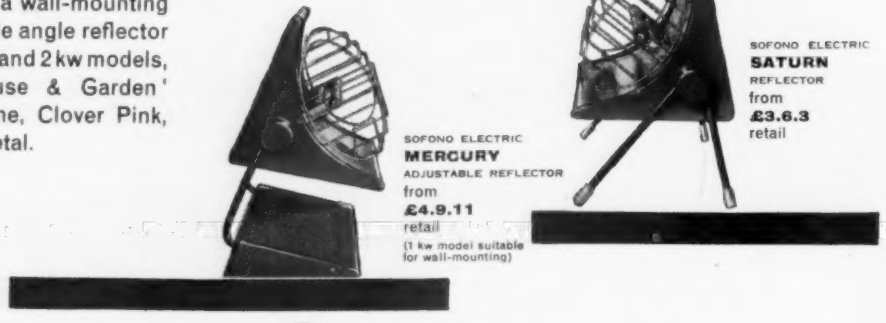

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£3.6.3
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SOFONO ELECTRIC
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from
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(1 kw model suitable for wall-mounting)

For further information on the 'Space-Age' range of SOFONO ELECTRIC HEATERS, please write to :—

SOFONO ELECTRICAL DIVISION, GRANGE CAMELON IRON CO. LTD., FALKIRK
A Federated Foundries Company.

You cannot buy better gear

SWITCHFUSES AND SWITCH SPLITTERS

- A RANGE OF S.P. & N. MAIN SWITCHGEAR FOR MODERN DOMESTIC INSTALLATIONS.
- AVAILABLE IN 15, 21, 30, 34 AND 60 AMP. SWITCH RATINGS.
- SAFE AND RELIABLE SLOW-BREAK A.C. FRONT OPERATED SWITCHES.
- ALL-INSULATED OR METAL CASES—FULLY INTERLOCKED FOR SAFETY.
- VITREOUS PORCELAIN FUSES IN H.R.C. OR BILL ARC DAMPING TYPE.
- SEE THE FULL RANGE IN ILLUSTRATED PRICE LIST No. CR.656.

BILL SWITCHGEAR LTD
BIRMINGHAM·20

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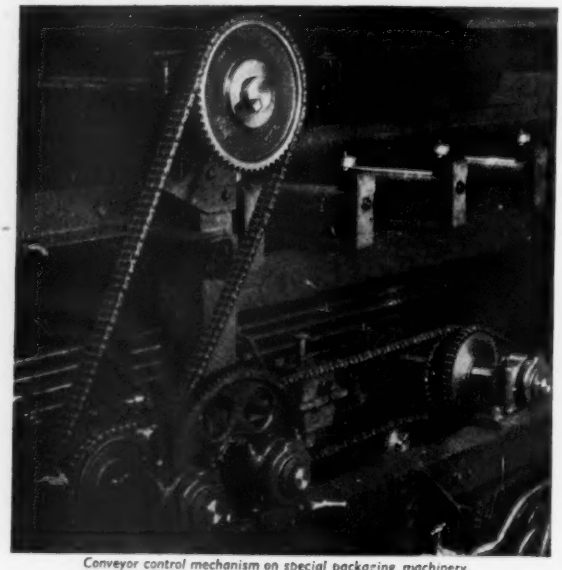
HIGHEST EFFICIENCY

POSITIVE RATIO

INFINITE ADAPTABILITY

UTMOST SPACE ECONOMY

OFF-THE-SHELF SERVICE



Conveyor control mechanism on special packaging machinery. "Timing" for accurate feeding is all-important on this type of machine and is ensured by the use of Renold stock chain drives.

Specify

RENOLD STOCK CHAIN DRIVES

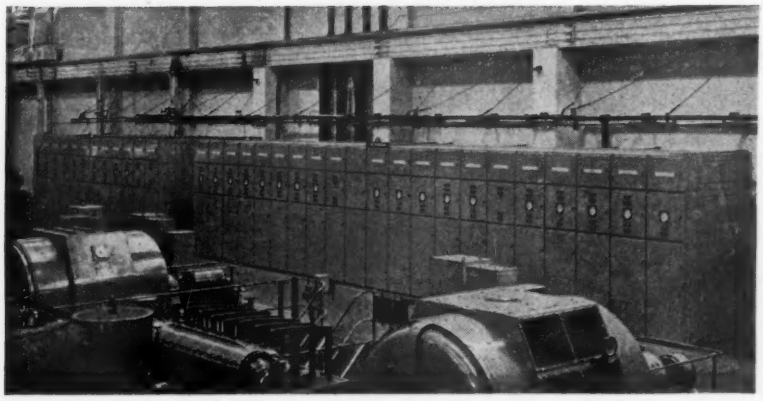
up to 140 h.p. in a wide variety of ratios

RENOLD —*the FIRST name in precision chain*

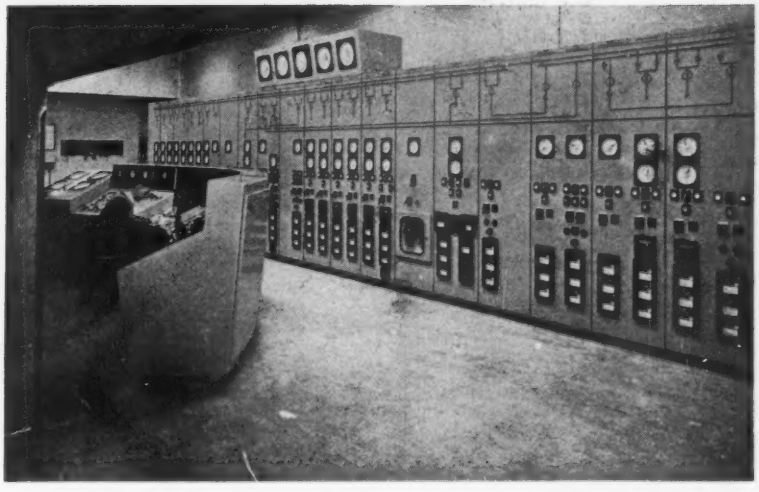
RENOLD CHAINS LIMITED · MANCHESTER

BOWATERS UNITED KINGDOM PULP AND PAPER MILLS LIMITED

Mersey Division



L.T. and H.T. Switchboards also supplied to: Kemsley Sittingbourne and Thames Divisions

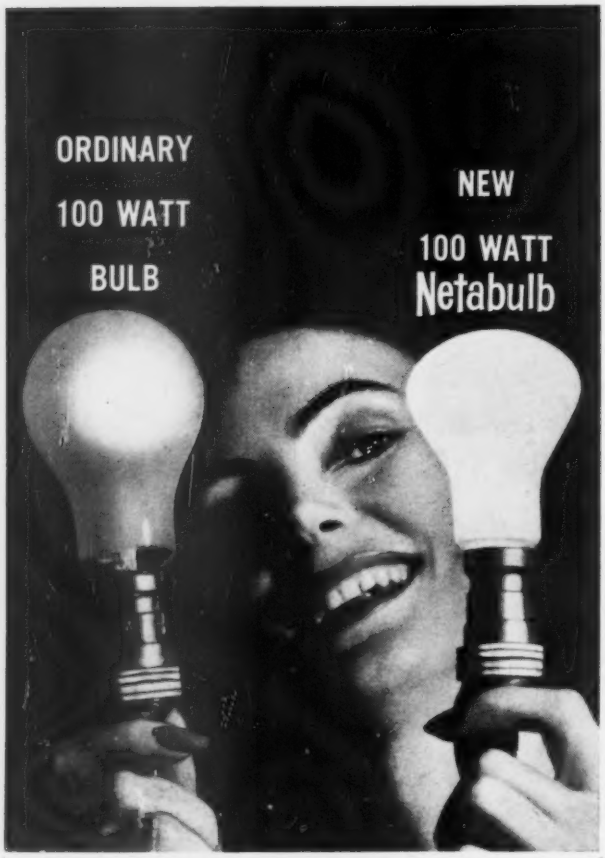


Illustrated above are the Main Switchboards having current carrying capacities up to 2400 amperes, making and breaking capacities 500 MVA at 11kV and 250 MVA at 3.3kV together with their associated control panels.

SWITCHGEAR & COWANS LTD

OLD TRAFFORD MANCHESTER

THE NEW Mazda Netabulb MEANS BIGGER SALES FOR YOU!



RIGHT, BRIGHT, AND VERY VERY NEW

It's right because of its new compact shape. The Mazda Netabulb is absolutely right for modern light fittings. It looks right, fits right, because it's so much smaller than ordinary bulbs.

It's bright because of its coiled-coil filament. The Mazda Netabulb gives a lot more light than ordinary single-coil bulbs (and because of its white interior coating it gives a lot more *comfortable* light).

It's very very new. Altogether the Mazda Netabulb is so new it's a revolution.

60 watt Silverlight ... 1/8½d
100 watt Silverlight ... 1/11½d
150 watt Silverlight ... 2/10d
150 watt Pearl ... 2/3d

READ ALL ABOUT IT. Ask your dealer for the Mazda booklet 'Netabulb in your home'.

Product tests have already shown that 4 out of 5 housewives prefer Netabulb — the most important step in bulb design for 30 years!

Backed by intensive advertising campaign

For the next 2½ months, *at least three-quarters of the housewives in your neighbourhood* will see Mazda Netabulb advertisements:

ON TV

Concentrated 5- and 30-second spots on all stations. Featured in advertising magazine programmes.

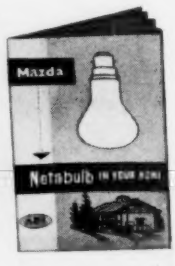
IN PRESS

Large-space advertisements in huge-circulation women's magazines:

Woman's Illustrated Woman's Own
Woman's Day Woman's Realm Woman's Weekly

In Radio Times, and in Provincial Press too, outside TV areas.

Stock and display with Netabulbs to satisfy the tremendous demand this powerful advertising will bring. Contact our representative who will book you a complete window dressing; ask also for special showcards and eye-catching point-of-sale material, and for the Mazda give-away booklets 'Netabulb in your home'. Or, if more convenient for you, *write direct to the Publicity Dept., A.E.I. Lamp & Lighting Co. Ltd., 44 Fitzroy Road, London, N.W.1.*



STOCK AND DISPLAY Netabulb NOW!

The line of horses stood, passive and close-packed, in a corner of the teeming, sun-scorched market. As the tall, long-jawed Arab, his gnarled and gimlet-eyed groom at his side, stopped to run his gaze along the row, the horse-dealer jerked into frantic action and an unbroken rattle of speech. Flapping a sinuous arm at a bay gelding in the centre of the line, he recited its qualities, quoted its price which, as the shrewd head shook, he halved and halved again.

The arm swished further down the line . . . a coal-black mare . . . the keen voice prattled, the price came tumbling . . . again the head shook. And so it went on until the tall Arab himself pointed to the calm grey stallion at the end of the row. Hands were raised, Allah was invoked, for there, O Lord and Master, was a horse among horses, and ah! the price . . . not to be lowered . . . but still the tall one called for the stallion to be untethered. A voice, low and knowing, came at the Arab's elbow. "You choose well, Effendi," the groom was saying, "the stallion is costly, but move him, and the whole line will fall down" — which it did.

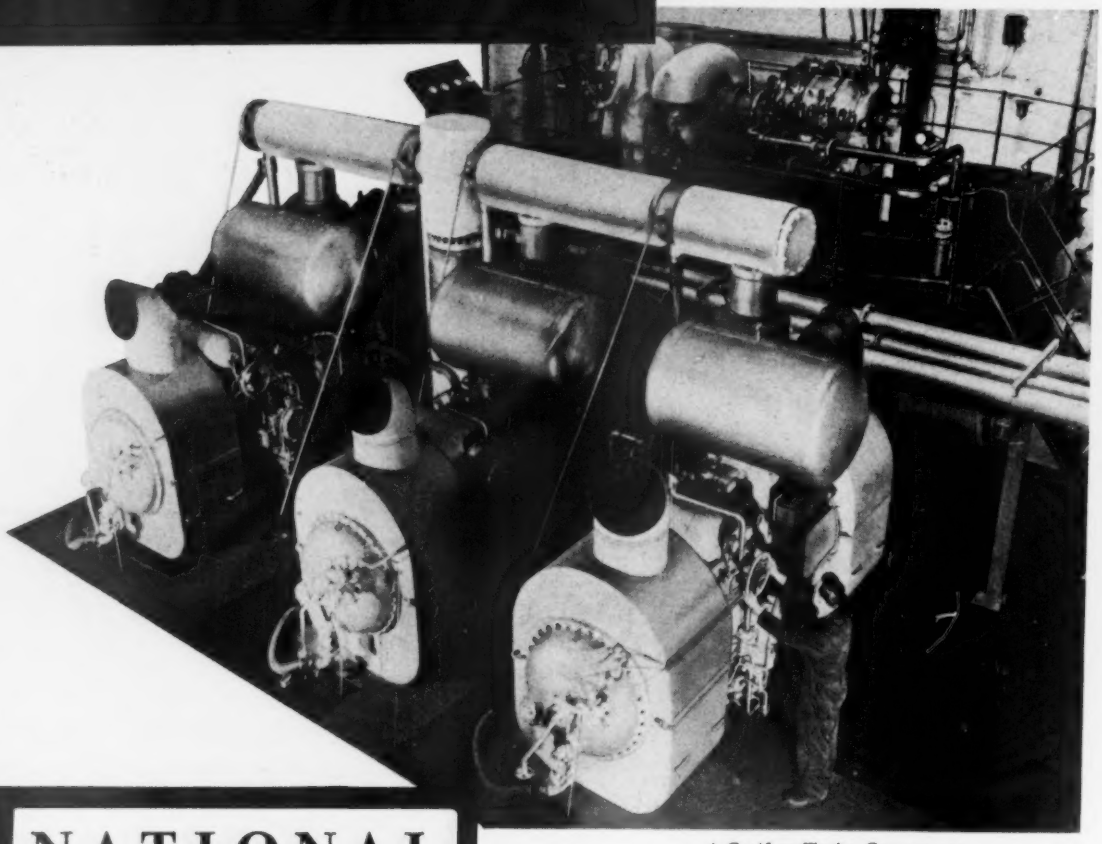
The wise among buyers – of cables as well as steeds – look beyond the immediate attractions of price. The telling factors are, they know, quality and the assurance of long, reliable service that meets exactly the customer's needs, no matter how magnificent or how modest they may be – and these are, indeed, the very factors which have gained for Mersey Cable Works a position of trust in the supply of cables of all descriptions to every branch of industry.

MERSEY CABLES

The unswerving choice of practised cable users

MERSEY CABLE WORKS LTD., LIVERPOOL 20. A TI COMPANY

FLEXIBLE POWER



NATIONAL

A Gasifyer/Turbo-Compressor set on test at National

FREE PISTON GASIFYERS FOR 1,000 TO 20,000 HORSEPOWER INSTALLATIONS

In conjunction with Hawker Siddeley Brush Turbines Ltd., National can supply complete plant for electrical power generation, pumping or compressor sets and for marine propulsion duties. Please ask for Publications 1801B and 1803

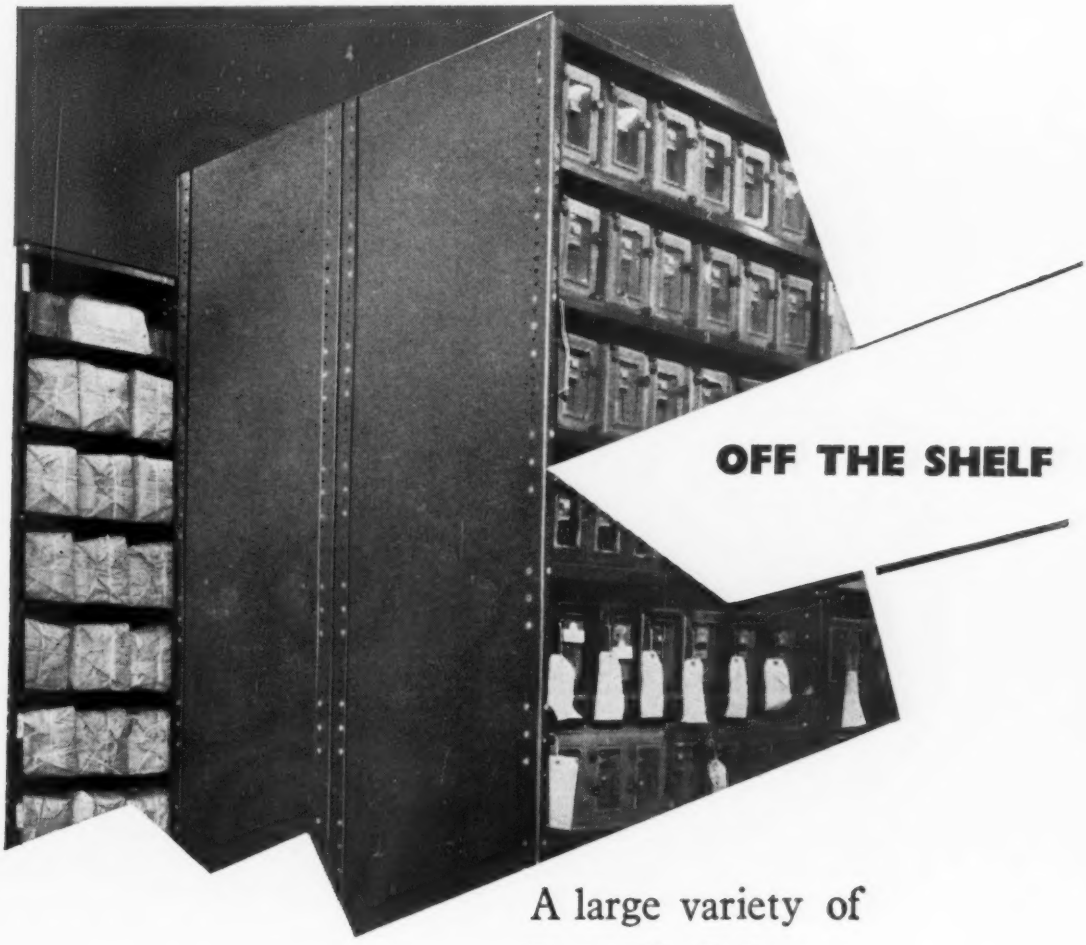
NATIONAL **FREE PISTON POWER LIMITED**
ASHTON-UNDER-LYNE · LANCASHIRE

Manufactured under Pescara / S.E.P. / Muntz Licence by

THE NATIONAL GAS AND OIL ENGINE CO. LTD., ASHTON-UNDER-LYNE, LANCASHIRE

A member of the Hawker Siddeley Group

NAT68



OFF THE SHELF

A large variety of Reyrolle Relays can be supplied "off the shelf". Many others can be supplied on a "short delivery" basis

Reyrolle

Relay ordering schedules are available on request

A. REYROLLE & COMPANY LIMITED - HEBBURN - COUNTY DURHAM - ENGLAND

A*

NEW Electrolux 65

All everyday cleaning with only two tools

Here's something completely new in home cleaning that every housewife will want to buy. With just two dual purpose tools this new Electrolux 65 does *all* the everyday cleaning. Electrolux, first with new developments through the years are first again with this brilliant new idea. An outstanding advance which makes home cleaning easier, quicker and more efficient than ever before!

Electrolux *excels* **Electrolux *excels***

ELECTROLUX LIMITED, 153/5 REGENT STREET, LONDON, W.1

NEW Electrolux 65

The cleaner everyone's going to want!

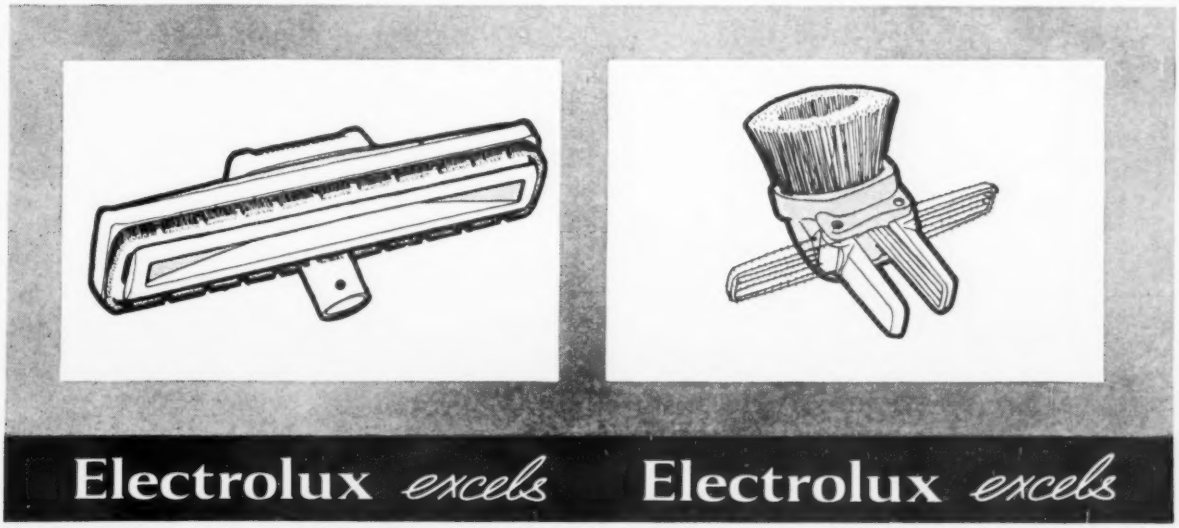
Here it is—the most advanced home cleaner ever made. From the superb design to the simple-to-adjust telescopic tube this cleaner combines every new idea, every helpful new feature that can bring housewives easier, quicker and more efficient home cleaning.

- **Deep reaching suction power**
- **Whisper quiet motor**
- **New telescopic tube**
- **Hygienic 'throw-away' dustbags**
- **New easy carry handle with wind-round flex storage**
- **New washable, plastic covered hose with snap action coupling**
- **Special crevice nozzle for cleaning out-of-the-way places**
- **Sprayer for carpet shampoos, paint, distemper etc.**
- **Unique air purifying pad**
- **Moves easily on nylon rollers**
- **Spring loop to hang cleaner ready for instant use**
- **Cash price £29.11.5**

ALL EVERYDAY CLEANING WITH ONLY TWO TOOLS

Carpet nozzle and floor brush in one Here's the carpet nozzle--but a press of the toe and—presto—it's the brush for hard floors. And it's just as simple to turn it into the carpet nozzle again! Electrolux does all the floor cleaning with one tool.

Dusting brush or cleaning nozzle at a touch Here's the dusting brush. But turn it round, open the wings and there's the nozzle for cleaning your upholstery, stair-carpets, curtains—and the TELESCOPIC EXTENSION TUBE brings everything within easy reach.



Electrolux *excels* Electrolux *excels*

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CABLE DIVISION

UNITES THE RESOURCES OF THREE GREAT COMPANIES

HENLEY CABLES

LIVERPOOL CABLES

SIEMENS EDISWAN

Three names having a long and honoured history in the manufacture and supply of every kind of wire and cable known to the Electrical Industry. Now, their resources, know-how, and manufacturing capacity are multiplied together to create something much greater than the sum of their individual facilities. Behind them the massive organisation of AEI will assure a steady flow of the latest technical data. There is no cable requirement too new, too big, too complicated, for this powerful and effective combination. By the same token, no order for ordinary small wires and cables is too small to have their ready and instant co-operation.

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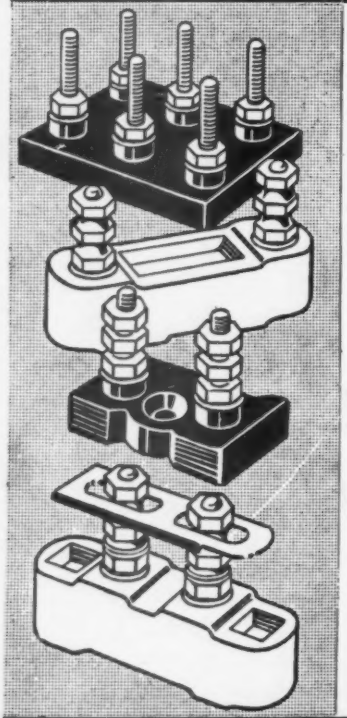
ANY METAL ANY QUANTITY

PRECISION PRODUCTION FOR KEENEST COSTINGS



By

Planwell

ENGINEERING LTD.

DORKING

TERMINAL UNITS

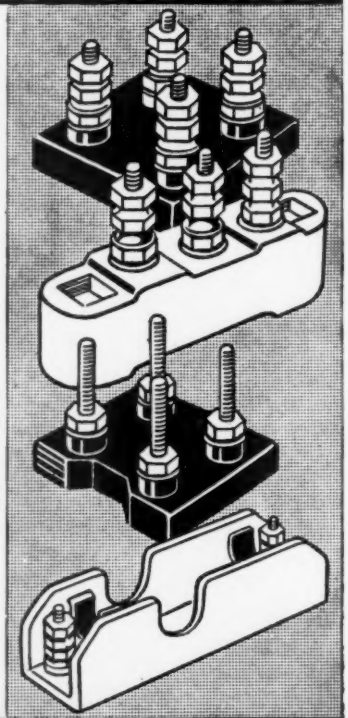
& GENERAL COMPONENTS

PORCELAIN & PLASTIC BASES

Precision built units to British Standard Specification with key, moulded plastic or porcelain bases for continuity connections in dead accurate alignment. O.B.A. brass posts nickel plated in non-shorting, immovable settings, constant sited to 1 in. centres side and forward.

Our stock lines include over 100 different designs suited to multi-purposes in signalling and general electrical practice. There's a P.L. Unit for practically every modern electrical assembly or

P.L. will produce economically at high speed to your specification. Send P.L. your design for quotation.



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Telephone: DORKING 4411 (3 Lines) Subsidiary of Lamp Manufacturing & Railway Supplies Ltd.

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THE BOWATER MERSEY MILL PROJECT

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HEAVY INDUSTRY INSTALLATION — OFFICES — FLATS AND HOUSING — HOSPITALS — SCHOOLS —

In fact, anything electrical at home and abroad.

Contractors to
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Central Electricity Generating Boards
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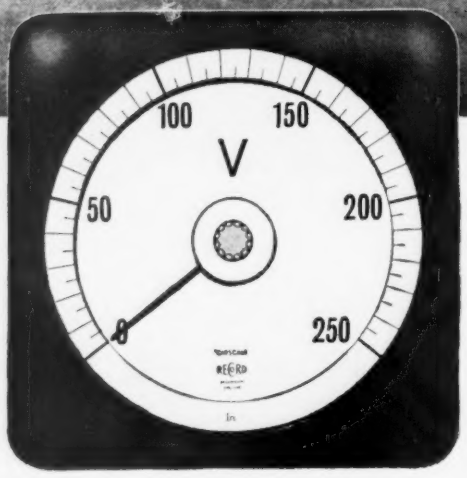
By kind permission of the Bowater Organisation. Control room of the Power Station of the Mersey Division of the Bowater Organisation (control board by Switchgear & Cowans Ltd.)



RECORD

'CIRSCALE' AMMETERS, VOLTMETERS, WATTMETERS, TACHOMETERS, etc.

RECORD GRAPHIC RECORDERS

We are proud to be associated with the new Mill extensions as suppliers of instruments not only for the Control Boards illustrated above, but for electrical equipment for Paper Machinery and Wood Grinder Plant.

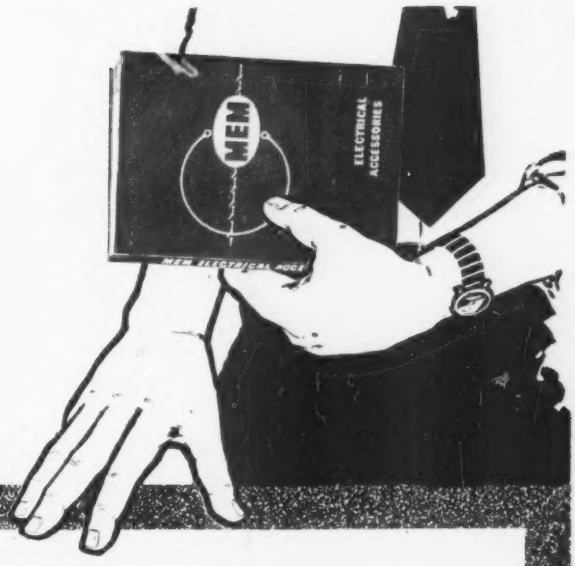
THE RECORD ELECTRICAL CO. LTD.

"Cirscale Works", Broadheath, Altrincham, Cheshire

Offices at Belfast, Birmingham, Dublin, Glasgow, Leeds, London.

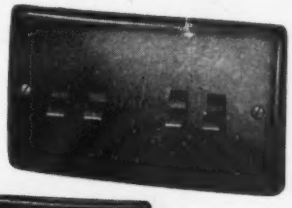
Telephones: Altrincham 3221 (5 lines)
Telegrams and Cables: Cirscale, Altrincham.

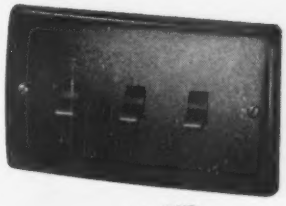
Electrical accessories from the MEM range



MEM "TAY" flush plate/switches and bell pushes

- All insulated. Current carrying parts mounted on high-grade vitreous porcelain.
- Solid Silver contacts.
- Modern styling eliminates dust traps.
- Plate and switch form a one-piece unit, self adjusting to varying plaster levels.
- Brown or ivory finish.


724 TFB

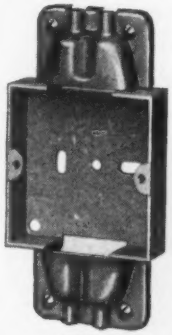

723 TFB

722 TFB

71 TFB

MEM "TAY" plaster depth boxes

- Wood, moulded and steel.
- Steel boxes available with insulated lugs adjustable for alignment.
- A range of steel boxes available with special clamps for M.I.C.C. cables.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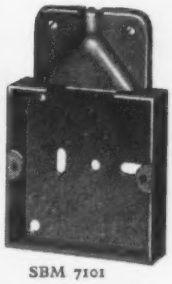
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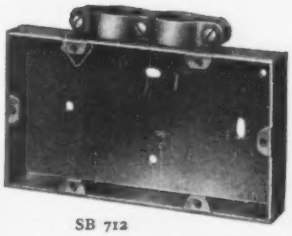
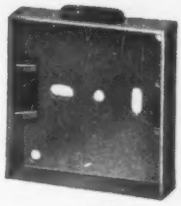

SB 712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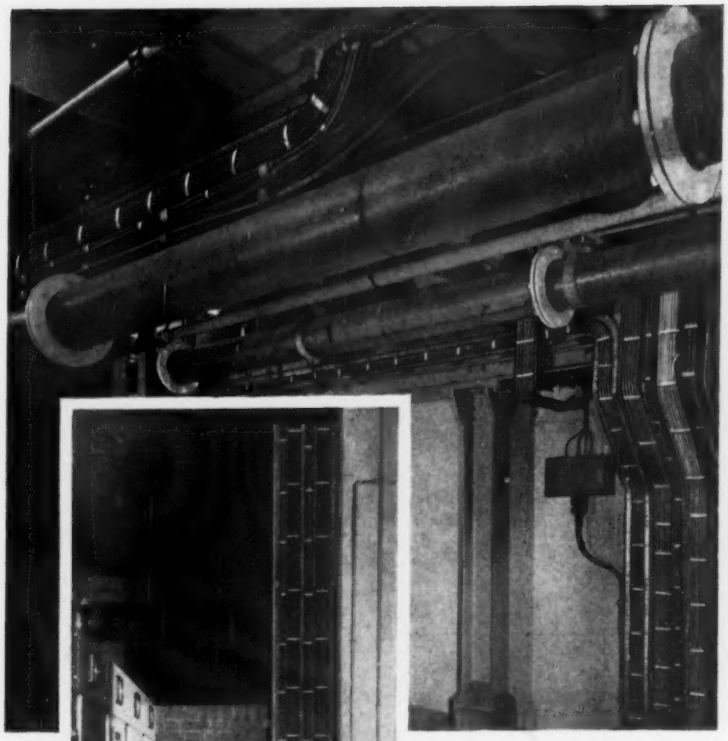
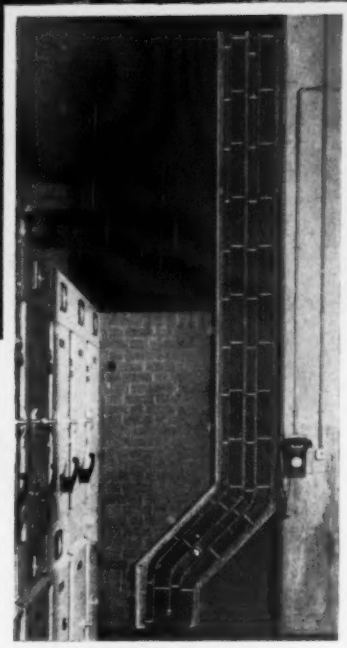
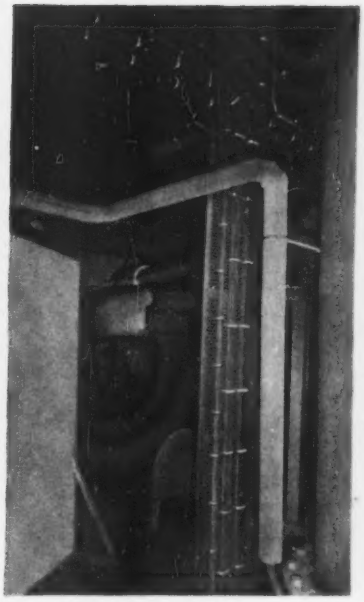




Long bank runs of power and control cables feeding grinder conveyors and situated in 3·3 k.v. substation.

No. 6 Machine Room. Pyrotenax control wiring for Super Calendar.



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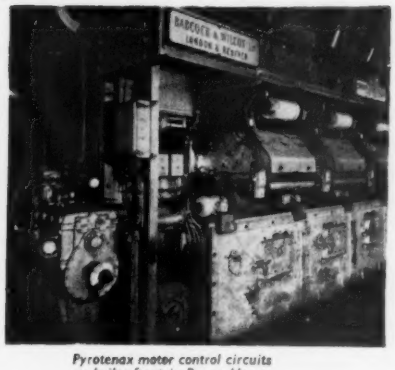

Pyrotenax motor control circuits on boiler front in Power House.

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'DORMAN' TYPE

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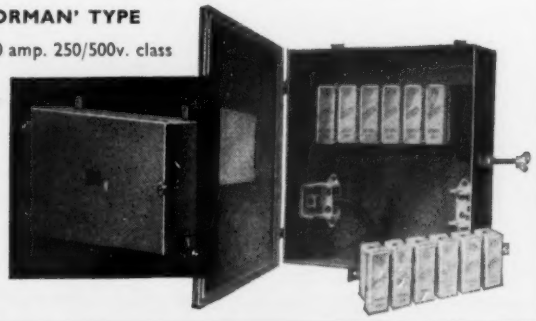
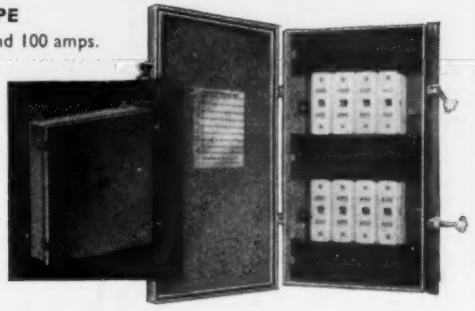


'ASC' TYPE

15/30, 60 and 100 amps.

500v. class



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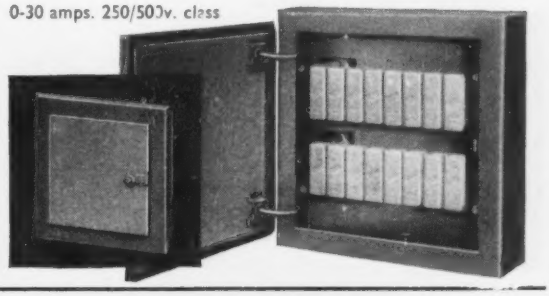

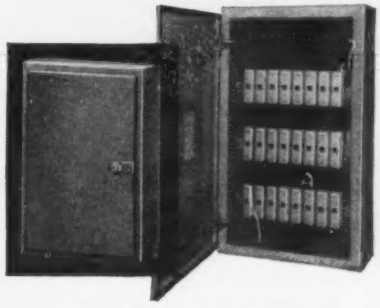

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2650/PH	60 watts	Clear Glass Without Guard	9/8
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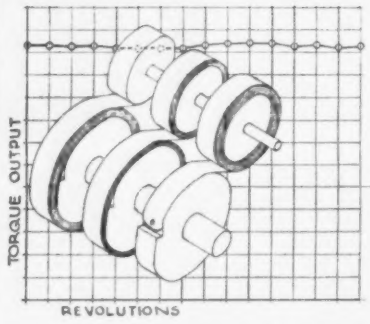

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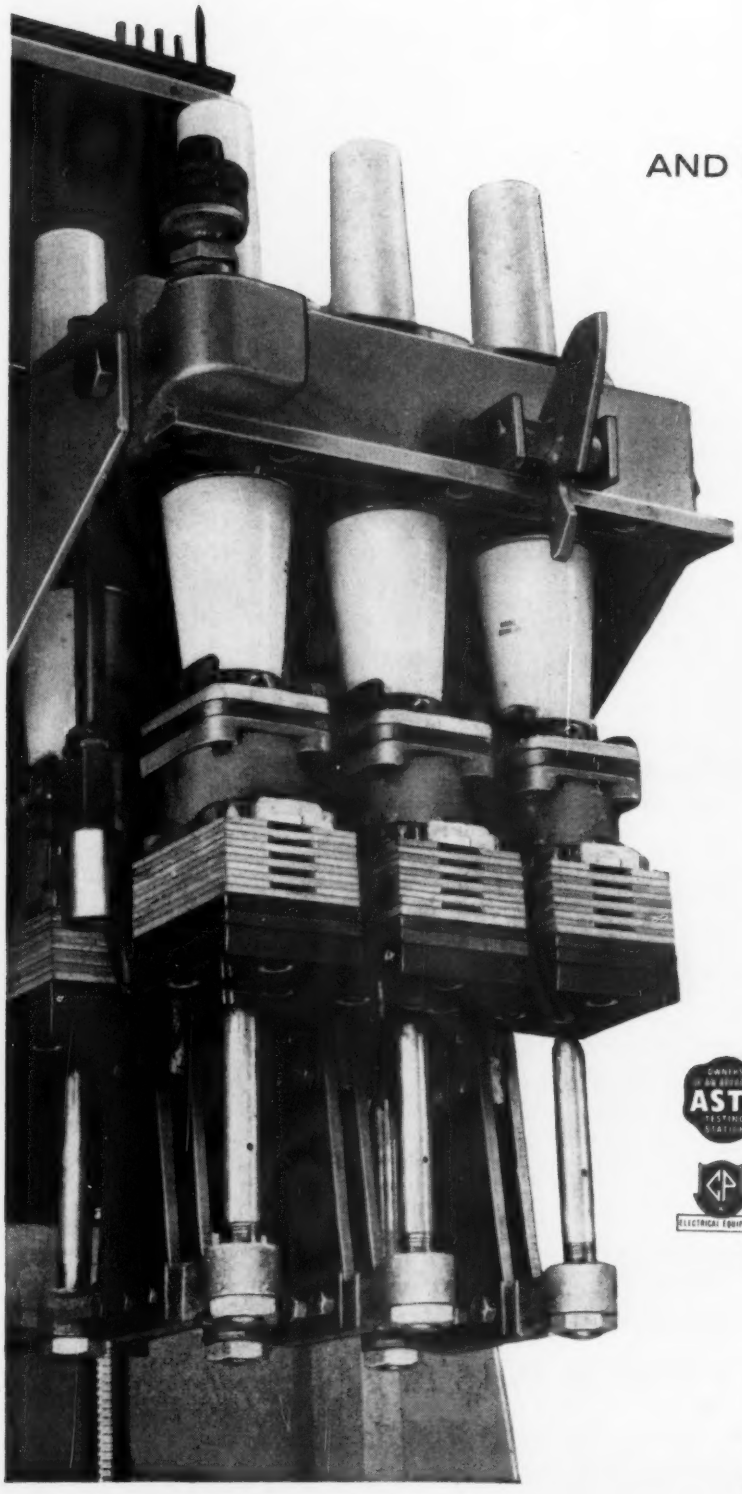

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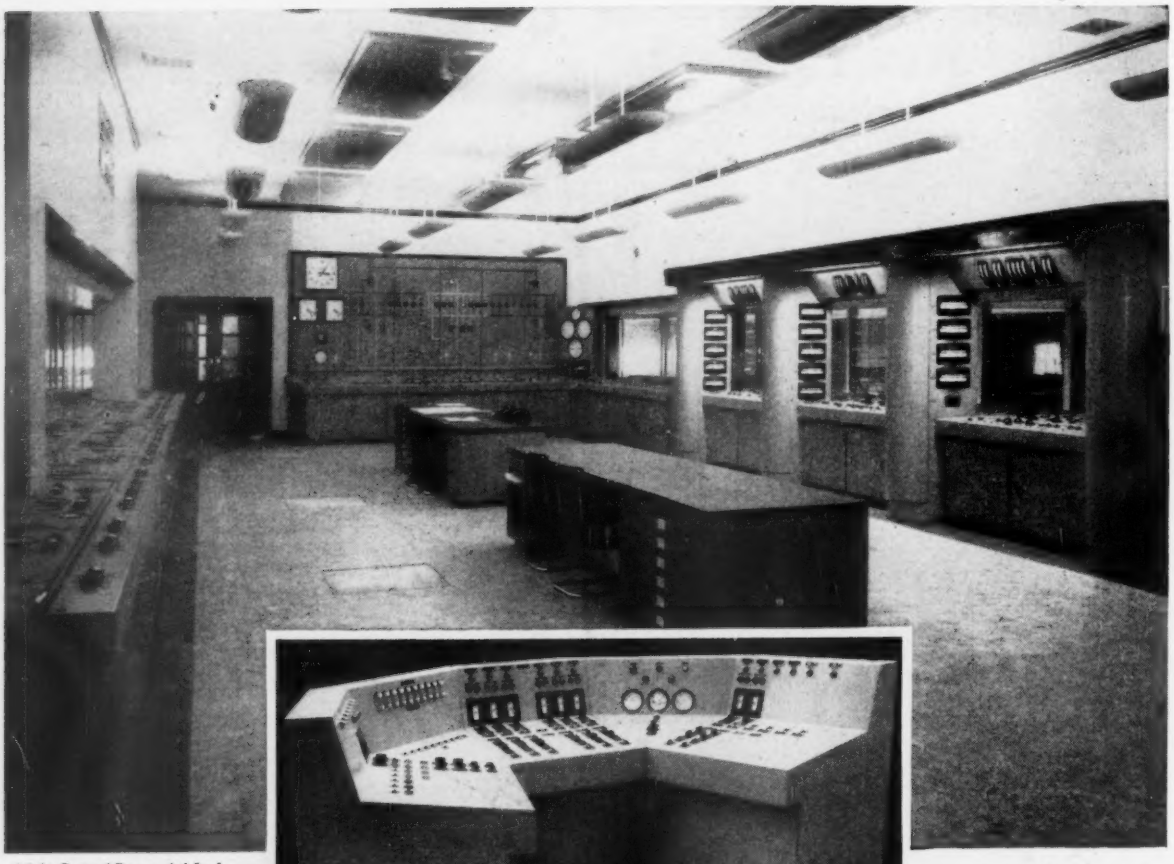
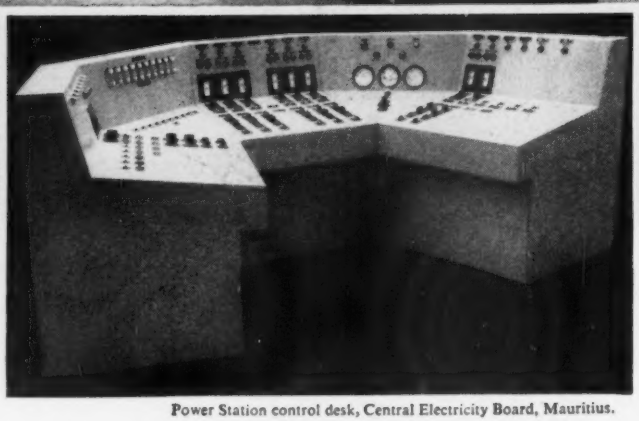


Main Control Room, Ashford Common Pumping Station of the Metropolitan Water Board.



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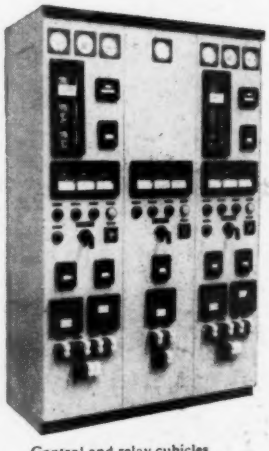

Control and relay cubicles for industrial application.

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for power control of

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S6

NEWS SHEET

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Smaller lamps bring risk of cable deterioration in lighting fittings warns the CMA; ability to fit 100 W in 60 W rated fittings can accelerate cable insulation failure. Suitable insulants available or wiring tails may be given sleeves of high temperature resistant design. (40, 59)

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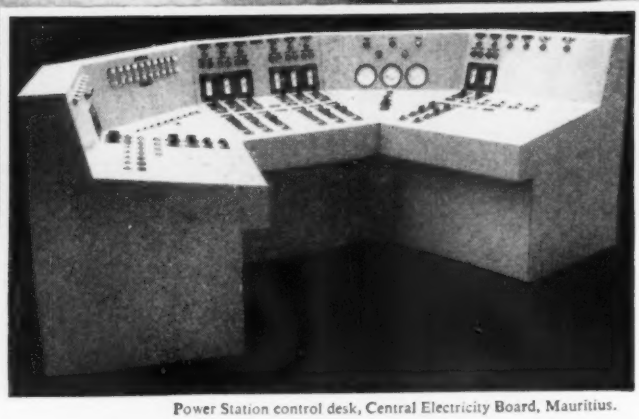

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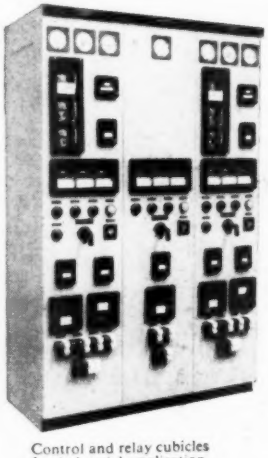

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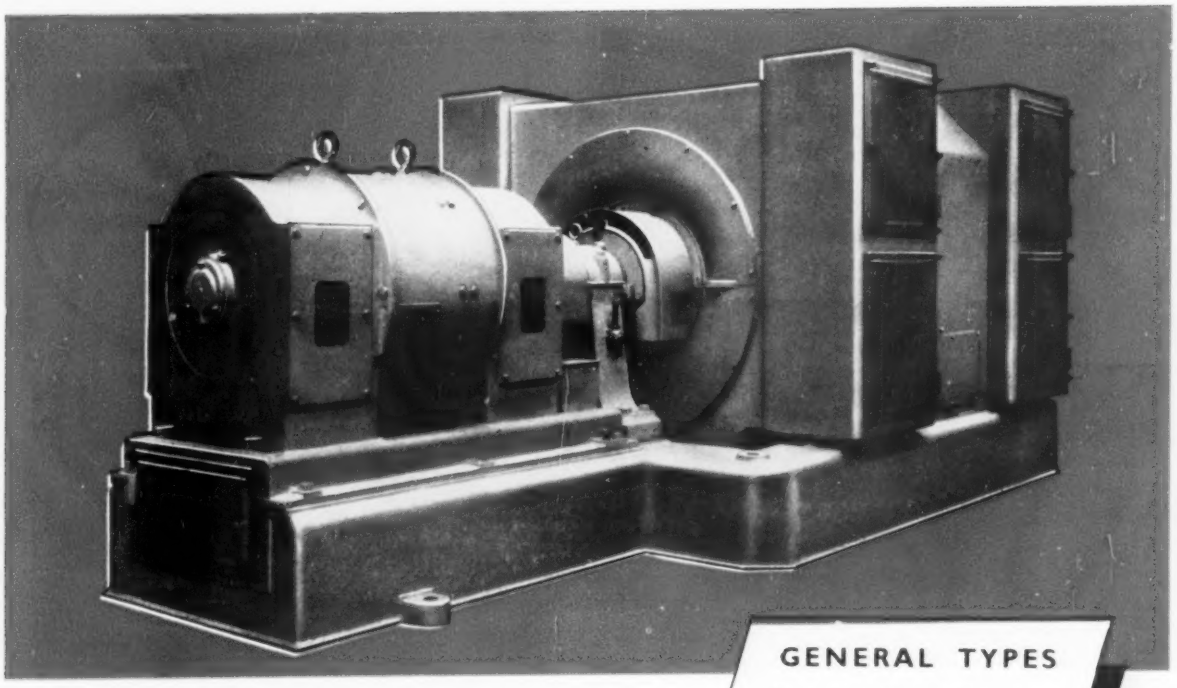

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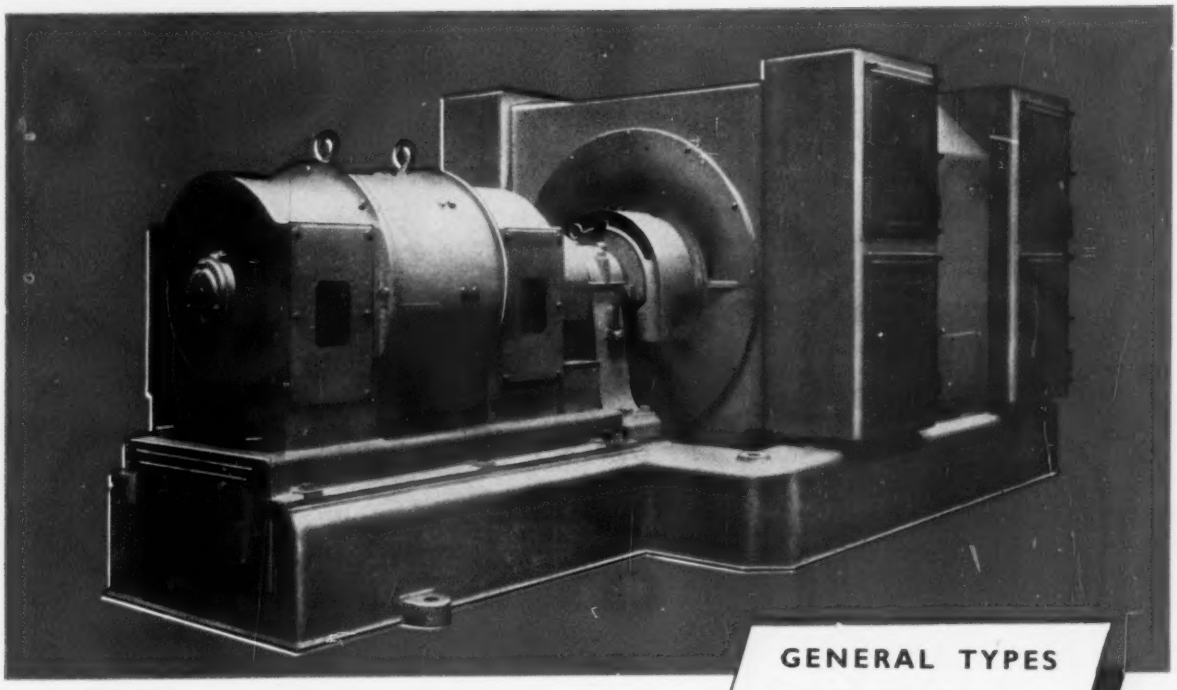
BUSINESS—£8m. order for copper wire rods from China shared by five British cable firms (69) . . . Edmundsons acquire another wholesaler, Stanley Weston (68) . . . Electromatic Washing Machines linked with Rolls Razor in rumours (69) . . . Kenwood amalgamation with Peerless-Ericsson completed and name change arranged. (68) . . . Berry's Electric open new Bletchley factory (71) . . . Simplex h.q. moves to Blythe Bridge (69) . . . Burco Dean launching new washing machine and spinner . . . Reduced profits by Marco Refrigerators but record by Regentone Radio . . . Ultra Electric give voting rights to "A" ordinary share-holders. (74)

OVERSEAS—English Electric order for six 37,500 kVA generators for Squaw Rapids (Saskatchewan) . . . Turkey's Hirfanli h.e. project, with British plant, inaugurated . . . India to expedite second and third stages of heavy plant factory . . . Greece to get dollar loan for Acheloos scheme. (54, 55)



1000 kW 6000-volt 1500 r.p.m. A.C. Generator with self-contained air filters and direct coupled exciter with main and pilot field systems and armatures mounted in a common frame with enclosing end brackets. The generator is one of many supplied for gas turbine drive.

Alternating Current

Generators

For direct coupling through gears to steam or gas turbines.

GENERAL TYPES

Duct Ventilated Type
Enclosed stator end covers arranged with air intake ducts for connection to air ducts in the foundations.

Enclosed Ventilated Type
Easily removable air filters embodied in the machine dispense with basement air ducts.

Totally Enclosed Air Circuit Type
Air coolers form an integral part of the machine and eliminate basement air ducts.

DESIGNED TO MEET INDIVIDUAL REQUIREMENTS AND OPERATING CONDITIONS

Write for pamphlet No. 72 dealing with geared turbine driven A.C. generators.

BRUCE PEEBLES & CO. LTD. EDINBURGH SCOTLAND

C

AEI engineers know the Papermaking Industry

Bowater's Mersey Groundwood Mill.
Four AEI 4,000 h.p. synchronous induction motors operating at 11,000 volts, and driving through gearboxes the chain-type log grinders at the Mersey Division of the Bowater Organisation.

From uncut timber to the finished sheet, AEI engineers know the Papermaking Industry. They have wide experience of its special problems and are on hand to advise on electric drive and control equipments for use at every stage of paper production.

AEI ELECTRIC DRIVES

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Associated Electrical Industries Limited
Motor and Control Gear Division
RUGBY & MANCHESTER, ENGLAND

INCORPORATING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V

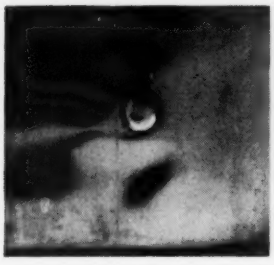
A5547

Alcho-Re Flux increases solder spread and eliminates corrosion

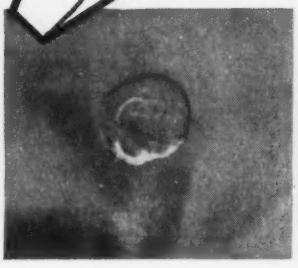
In laboratory and production tests Alcho-Re fluxes are proved to increase solder flow, speeding soldering times and cutting costs.

Alcho-Re fluxes in paste or fluid form are completely non-corrosive. They cannot attack solder or base metal and eliminate the dangers of dry or H.R. joints.

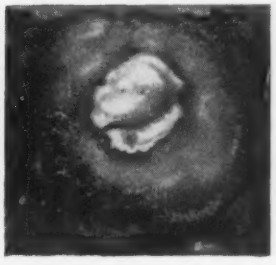
Alcho-Re fluxes conform to specification D.T.D.599 and R.C.S.1000 and are approved by A.I.D., C.I.A., I.F.V., D.C.I. and G.P.O.



Plain resin flux restricting solder flow.

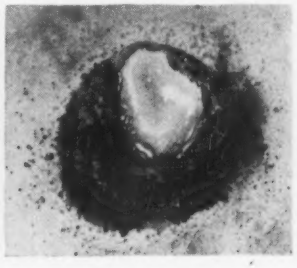


SOLDER *spread* IS INCREASED with the positive fluxing action of ALCHO-RE.



ELIMINATES CORROSION

Note the completely inert Alcho-Re residue after three months storage.



DANGEROUS! CORROSION

The residue from an active flux caused this corrosion after only three days.

FRY'S Metal Foundries Limited

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550 MW

Babcock Radiant reheat type, pulverized-fuel-fired, with an evaporation of 3,750,000 lb./hr. at 2400 lb./sq. in. 1055 F, for THORPE MARSH power station, Central Electricity Generating Board.

300 MW

Radiant, reheat units, pulverized-fuel-fired, for WEST THURROCK power station.

200 MW

Radiant, reheat units, pulverized-fuel-fired, for WEST THURROCK, WILLINGTON 'B', KINCARDINE and HAZELWOOD (Australia) power stations.

100 MW TO 120

Radiant units (four with reheat) pulverized-fuel or 'Cyclone' fired, of capacities from 100 to 120 MW, for BLYTH 'A', RUGELEY, USKMOUTH 'B', PADIHAM 'B', FERRYBRIDGE 'B', ASNAES (Denmark), PONT BRULE (Belgium); and also the six 100 MW units at CASTLE DONINGTON power station, which topped the efficiency table in 1959.

Central station boiler development in recent years has been remarkable for the steep rise in unit capacities, with parallel advances in steam conditions and the extensive use of reheat; achieving valuable gains in thermal efficiency. This development reflects intensive progress — in design, engineering and manufacture — by the BABCOCK organization, which has supplied, or is currently manufacturing, a considerable number of boilers of from 100 to 300 MW capacity, and which is now to supply a unit of 550 MW capacity — the largest in the world and the first to provide this huge output from a single-furnace design.

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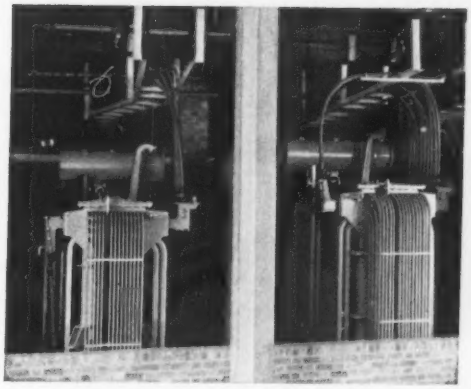
BOWATER'S MERSEY MILLS

J. & P. plant and cable in paper mill development scheme

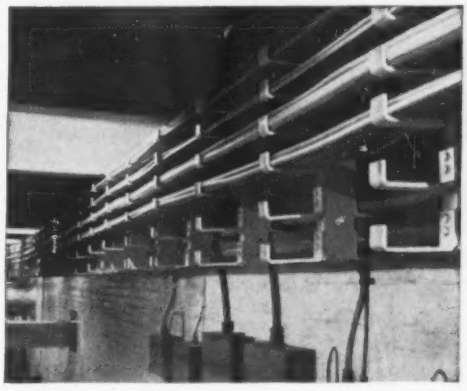
The association and friendship which exists between the Bowater Paper Corporation as users, and Johnson & Phillips Limited as suppliers of electrical equipment, is of over thirty years duration. It emphasises our customers' faith in the products which we have been privileged to supply and is yet another example of the service to industry which we provide under the mark that means that "little more" in quality.

J. & P. Plant installed at the Mersey Division Mills includes eight 11kV/430V transformers — four rated at 2,750 kVA and four at 2,000 kVA—and an 11-panel 3·3 kV air-insulated metalclad switchboard with remotely controlled circuit-breakers.

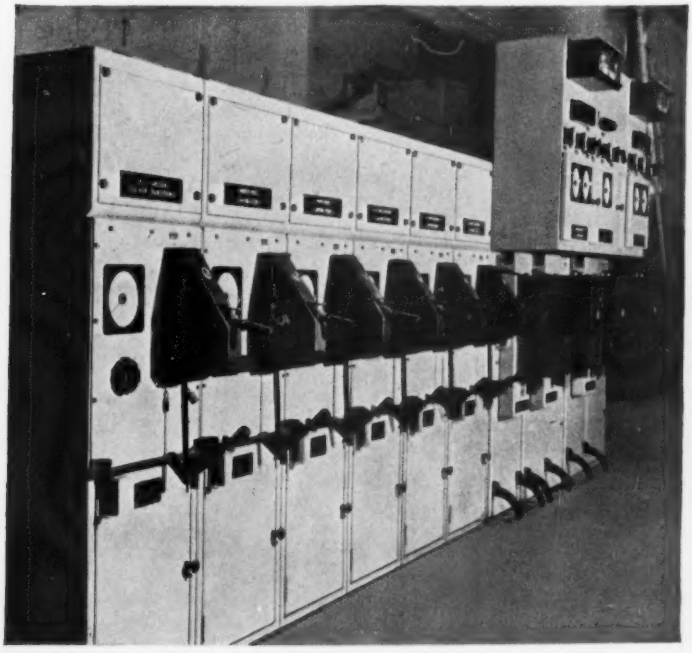
11 kV, 3·3 kV and 1,100 V paper insulated lead or aluminium sheathed cables of J. & P. manufacture installed by Tanjon (N/C) Ltd., total over 13,000 yards.



Two of the eight J. & P. transformers supplied for the great construction and extension scheme.



J. & P. 1,100V paper insulated, aluminium sheathed cables with p.v.c. extruded overall to afford protection against corrosion.



The 11-panel air-insulated, metalclad switchboard comprising 3 oil circuit-breaker units and 8 fuse-switch units.

The Mark that means that "little more" in quality

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*

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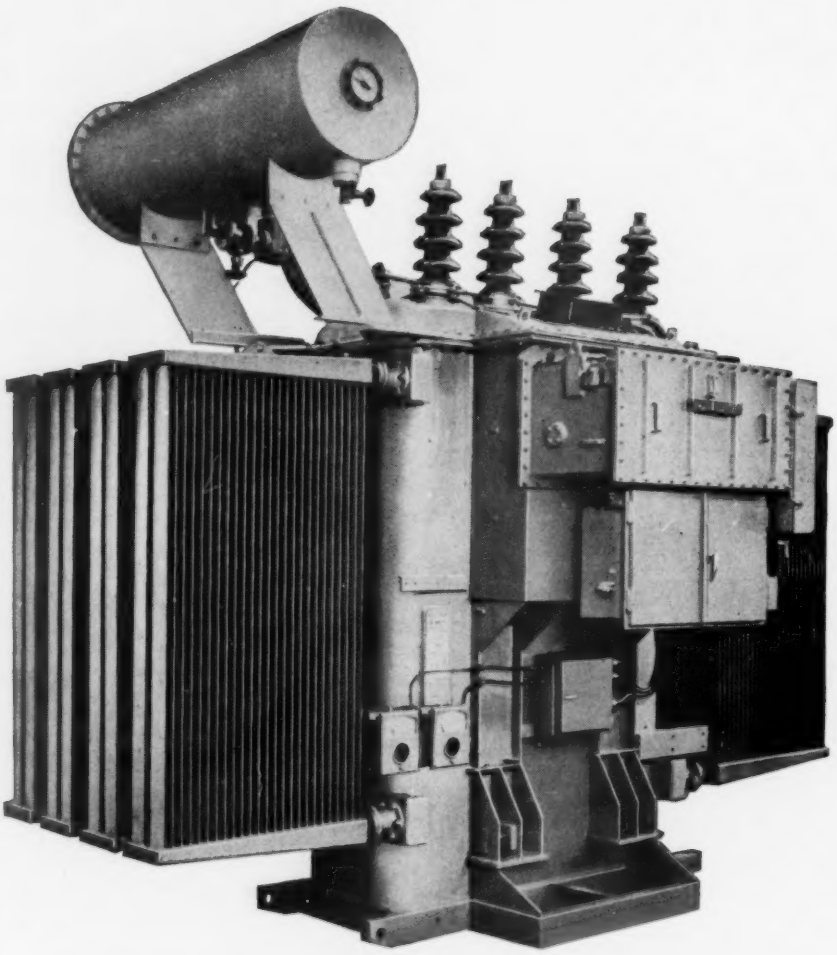

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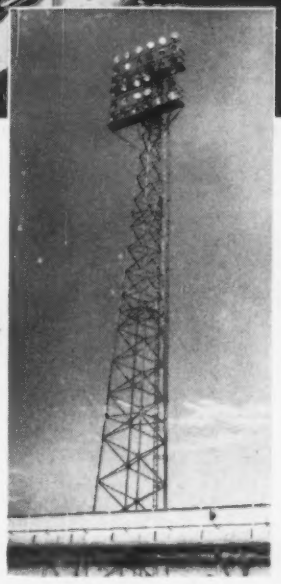
making light work of it

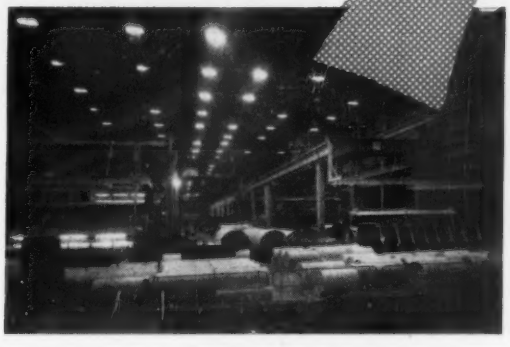
AT THE NEW BOWATER PLANT

INSIDE AND OUTSIDE LIGHTING FITTINGS BY SIMPLEX



Simplex lighting fittings are installed at the NEW PLANT of the Mersey Division of the Bowater Organisation.

Inside, high bay blended fittings were used. These fittings give colour correction to a mercury lamp by blending with a tungsten lamp. Reflectors are finished in Simplex Arvit—an acid resistant vitreous enamel. Outside illumination is provided by a concentration of weatherproof general purpose floodlights mounted on towers. Simplex make industrial lighting fittings of every type for indoor and outdoor use and have a team of lighting specialists who will be happy to advise you on any problem.



Simplex lighting fittings installed are general purpose floodlight projectors and blended fittings.

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Branches throughout Britain and agents throughout the world.

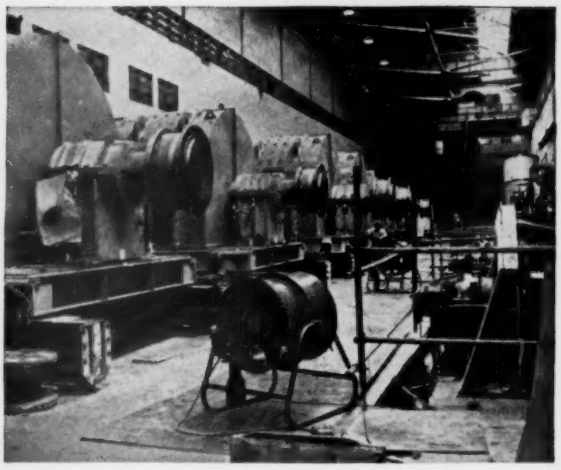
Simplex

A TI COMPANY

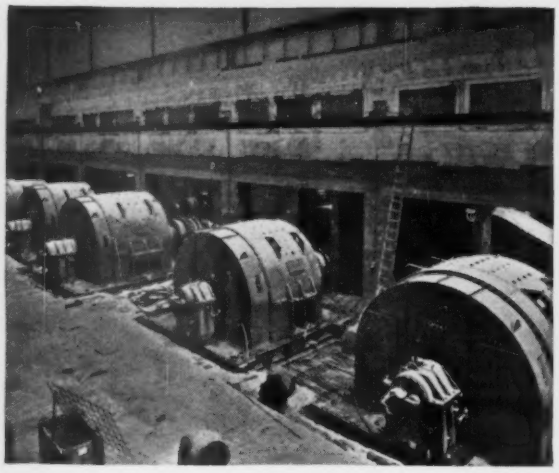
Target beaten in

At the Ebbw Vale Steelworks of Richard Thomas and Baldwins Limited re-motoring of the continuous hot strip mill was accomplished in only 19 days—one day ahead of schedule. This operation involved the removal of 1,500 tons of equipment and its replacement by new machinery.

The G.E.C., as the main contractors for the finishing mill electrical work, operated in close collaboration with Richard Thomas and Baldwins Limited and the Consulting Engineers, McLellan and Partners. The contract covered the supply and erection of the main drive motors, rectifiers, transformers, d.c. circuit breakers and all protective, control and instrumentation equipment for the finishing mill.



1. With the new, more powerful motors lined up behind the old, and with much of the associated equipment already installed, everything was set for the changeover.

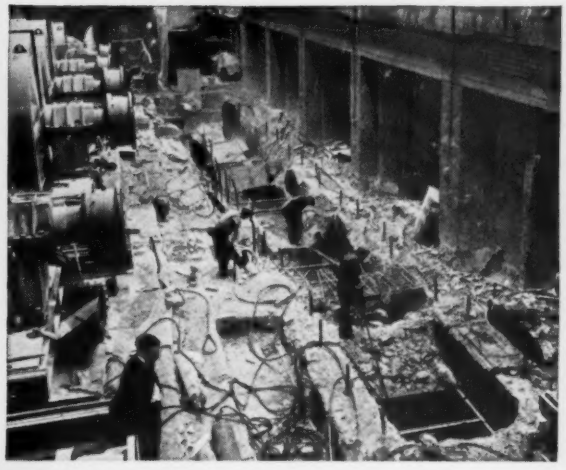


4. The mill couplings were then fitted. The new total of 23,000 horsepower will give the finishing mill a substantially higher output than the former capacity of 16,000 tons per week.

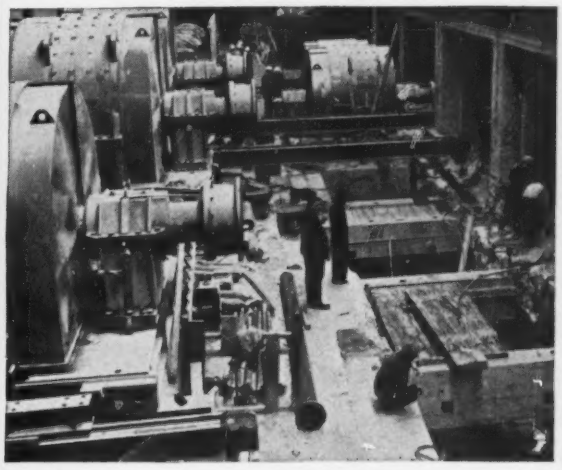
5. From the new, wide-view pulpit, the operators control the rolling operations. The mill voltage is automatically set up and checked by means of indicator lamps which show when each operation in the sequence is complete.

G.E.C. OF ENGLAND

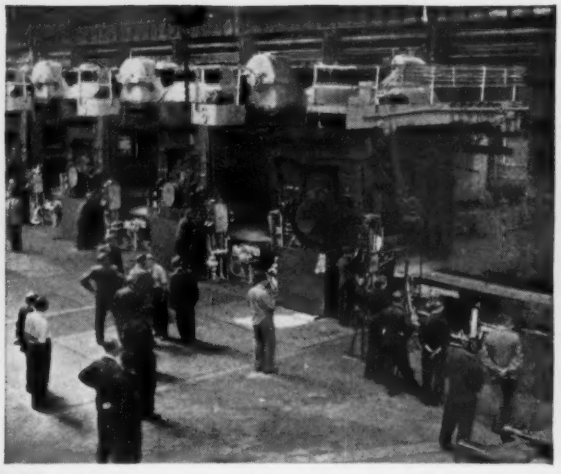
mill re-motoring



2. Work started at 9 a.m. on August 1st, within minutes of the last strip passing over the run-out table, and foundations were quickly prepared for the new machines.



3. Work went on all round the clock. Winches were used to slide 480 tons of motors on heavy beams across the motor room and the machines were lowered on to the foundations.



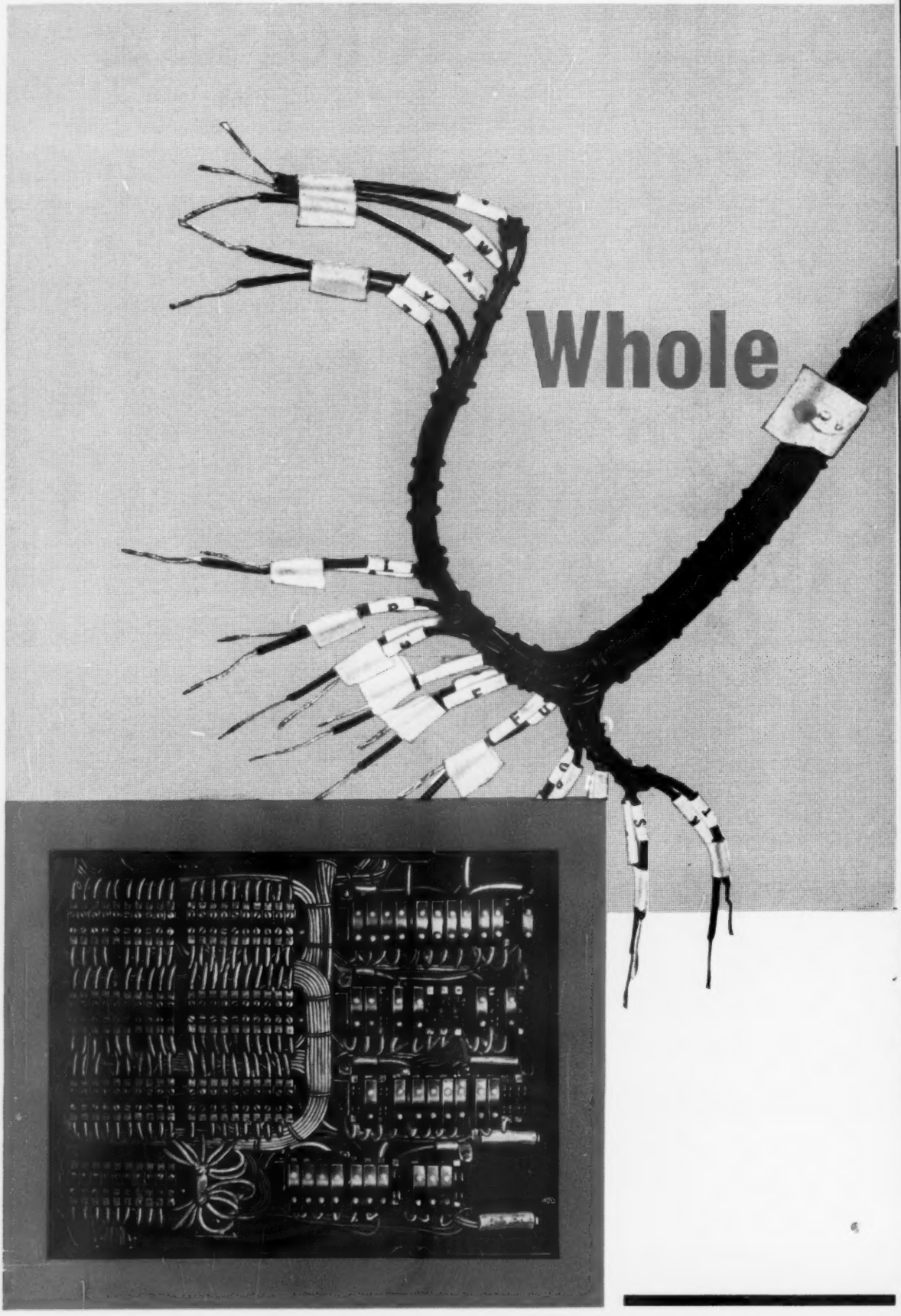
6. At 12.40 p.m. on August 20th the mill commenced rolling, so bringing the changeover to a successful conclusion in record time.

7. More than 60 tons of busbars and cables link the motors, the control gear and 19,800 kW of grid-controlled rectifiers which provide power for the finishing train.

THE GENERAL ELECTRIC COMPANY LIMITED OF ENGLAND

Plant Co-ordination Division, Birmingham, 6

341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Preformed wiring by Plessey, in conjunction with Plessey plugs and sockets, solves many of the problems encountered in the making up of wiring assemblies used in the manufacture of electronic and electrical equipment, and the benefits both structurally and economically are considerable.

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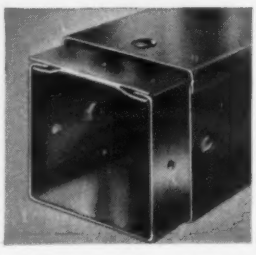

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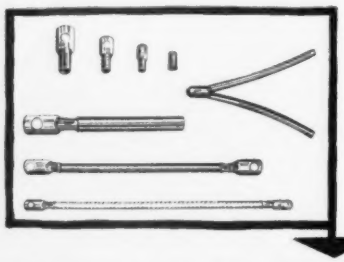

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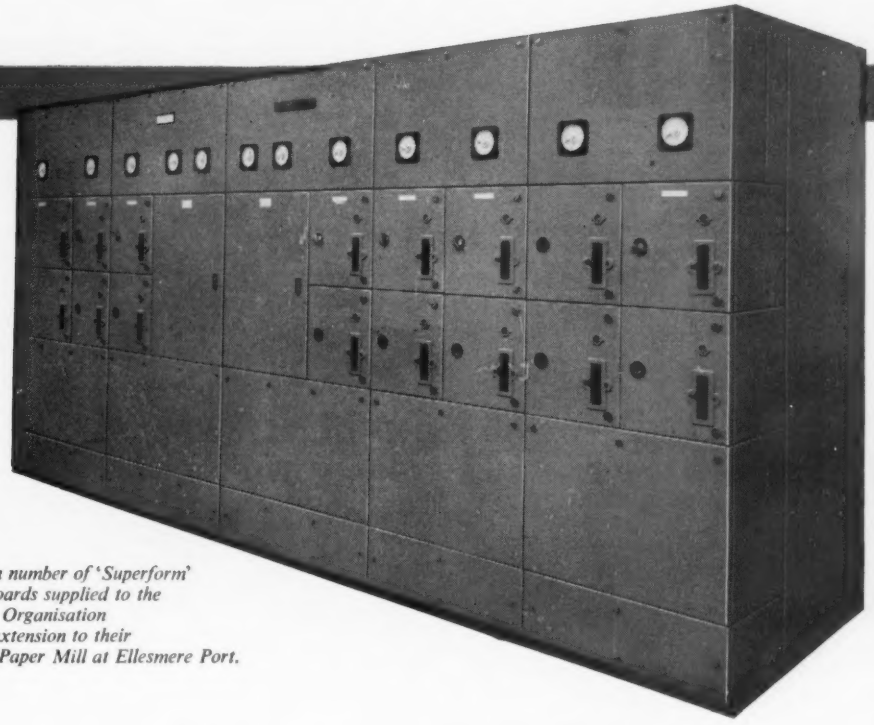

One of a number of 'Superform' Switchboards supplied to the Bowater Organisation for the extension to their Mersey Paper Mill at Ellesmere Port.

Composite boards can be supplied covering all the requirements of modern M.V. systems, the range of equipment including:

- Air circuit-breakers up to 3000 amps.
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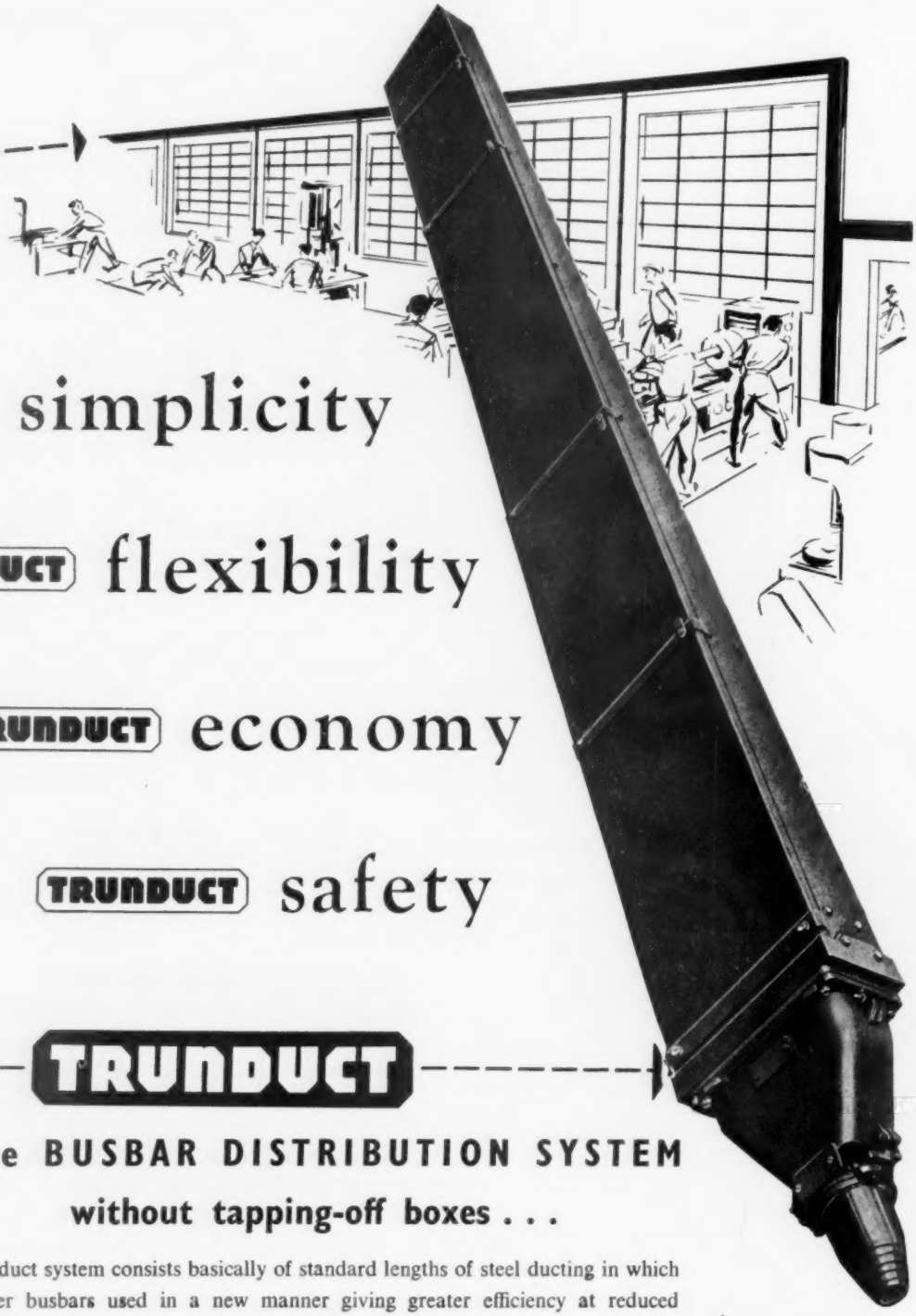

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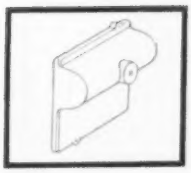
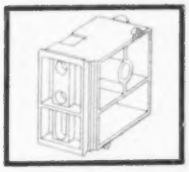


DMC* electrically...



60 amp. Input Junction Box moulded by Aldridge Plastics Ltd. for Siemens Edison Swan. The four moulded components are shown in the inset drawings.

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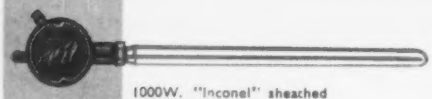

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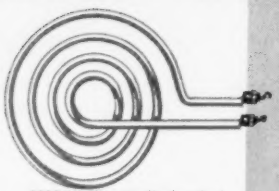
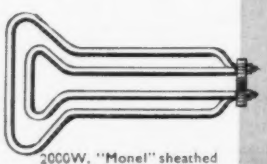
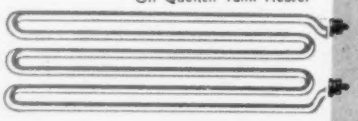


2000W. "Incoloy" sheathed Forced Air Element for Greenhouse heating



2000W. "Monel" sheathed Oil Quench Tank Heater



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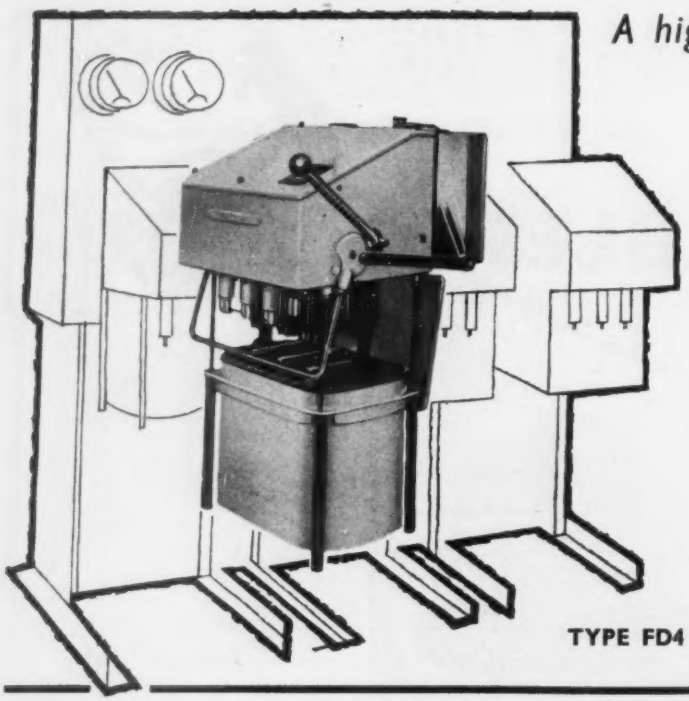

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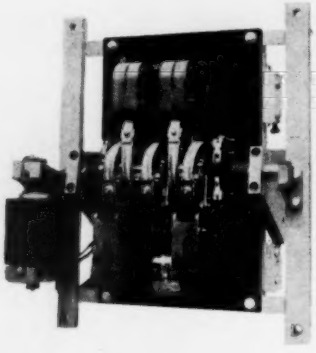

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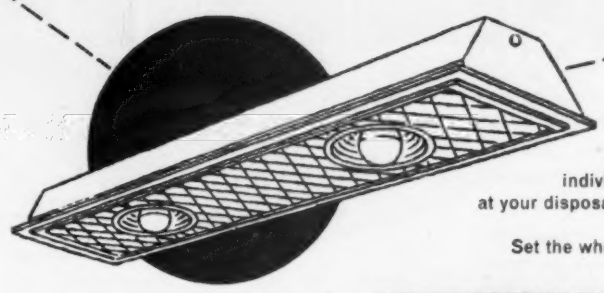

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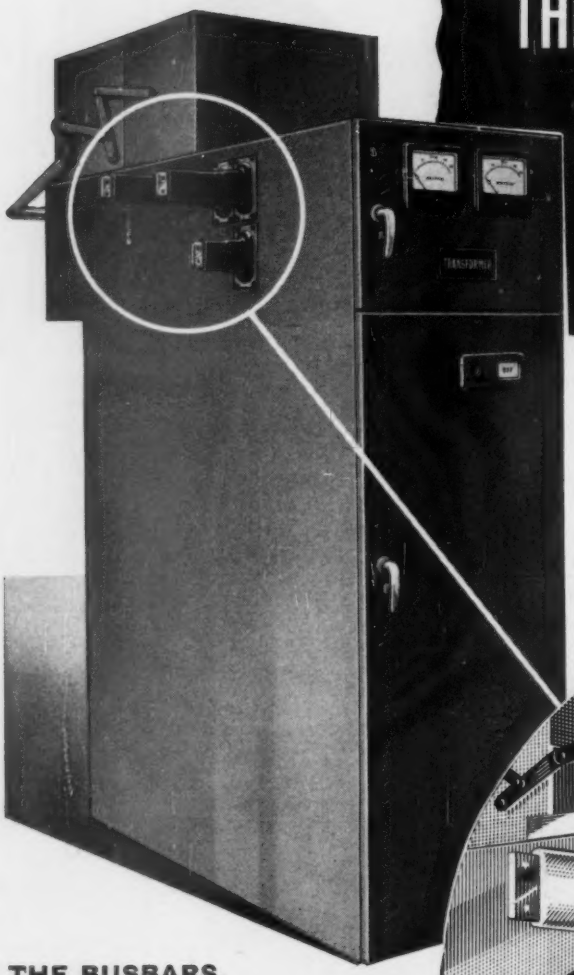

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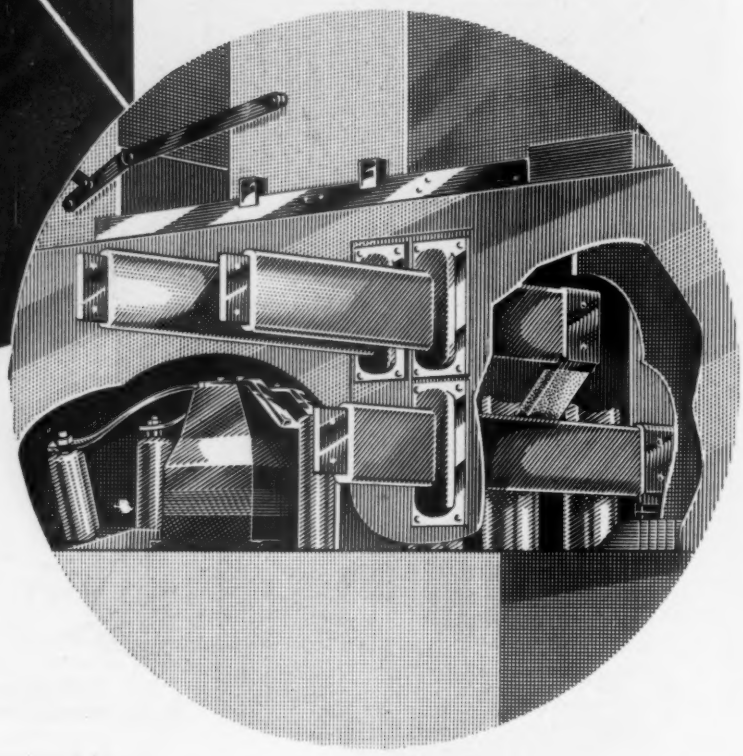

THE BUSBARS,

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ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
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Dans ce numéro

Fabrication de papier à grande vitesse 41

Deux machines récemment construites pour la fabrication du papier ont été conçues pour un rendement de 710 mètres/min. de papier journal. Les diverses sections des machines sont commandées par des moteurs du système Ward-Leonard à régulation électronique de vitesse à thyratron ou à amplificateur magnétique. Les faibles écarts de vitesse entre les diverses sections des machines sont mesurés avec précision, au moyen de compteurs-dékatrons munis d'indicateurs selsyn. Les calandres à glacer et les bobineuses sont commandées par un système à amplidyne, qui assure le maintien d'une tension uniforme du papier. Un broyeur de bois indépendant est actionné par quatre moteurs synchrones de 4.000 CV. à commande électronique de la charge et du facteur de puissance.

Appareils de protection 48

Une communication à l'Institution of Electrical Engineers expose dans ses grandes lignes, la protection des systèmes électriques. La vitesse d'operation des relais a été portée d'une sec. en 1915 à 0, 02 à 0, 04 secs. en 1950.

Etude sur les collecteurs opérant à grande vitesse 51

On a constaté que le rebondissement des balais est un facteur important d'une mauvaise opération des collecteurs de générateurs d'aviation à courant continu, en expérimentant avec des balais de peu d'inertie maintenus contre le collecteur par des jets d'air. La variation du courant dans un enroulement particulier, pendant l'opération de la machine, a été déterminée par l'intégration du courant dérivé d'une bobine exploratrice embrassant l'un des conducteurs de l'induit.

In dieser Nummer

Beschleunigte Papierfabrikation 41

Zwei vor kurzem fertiggestellte Papiermaschinen sind auf eine Leistung von 710 Meter Zeitungspapier in der Minute ausgerichtet. Der Antrieb erfolgt durch drehzahlabhängige Teilantriebe, System Ward Leonard, mit einer elektronischen Steuerung, die entweder mit Tyratronen oder magnetischen Verstärkern arbeitet. Geringe Drehzahlunterschiede zwischen einzelnen Maschinenabschnitten werden mittels eines Dekatron-Zählsystems genau gemessen und mittels eines Selsyn-Systems zur Ablesung gebracht. Die vorgesehenen Grossskalander und Aufspulvorrichtungen sind mit Amplidyn-Reglern ausgestattet, die für die Aufrechterhaltung konstanter Spannung der Papierbahn sorgen. Eine getrennte Holzschleifmaschine wird durch vier Synchronmotore von je 4 000 PS angetrieben mit elektronischer Steuerung des Belastungs- und Leistungsfaktors.

Schutzegerät 48

Ein vor kurzem im elektrotechnischen Institut (Institution of Electrical Eingineers) gehaltener Vortrag befasst sich mit einer allgemeinen Uebersicht der zum Schutze elektrischer Maschinen und Anlagen verwendeten Verfahren und Vorrichtungen. Es wurde u.A. berichtet, dass die mittlere Relaisablaufzeit von 1, 0 sec im Jahre 1915 auf 0, 02 bis 0, 04 sec im Jahre 1950 herabgesetzt wurde.

Prüfung schnellaufender Kommutatoren 51

Durch die versuchsweise Anwendung von Bürsten geringer Trägheit, die mittels Luftstrahl in Berührung mit dem Kommutator gehalten werden, wurde der Beweis dafür erbracht, dass Bürstenvibration entscheidend zur mangelhaften Kommutation bei schnellaufenden Gleichstrommaschinen für Flugzeuge beiträgt. Die in einer vorbestimmten Spule während der Kommutation auftretenden Stromschwankungen wurden gemessen und zwar durch Integrierung des Signals, das von einer Suchspule erhalten wurde, die um einen Ankerleiter gelegt wurde.

Pulp to Paper 41

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Organic Semi-conductors in U.S.S.R. 49

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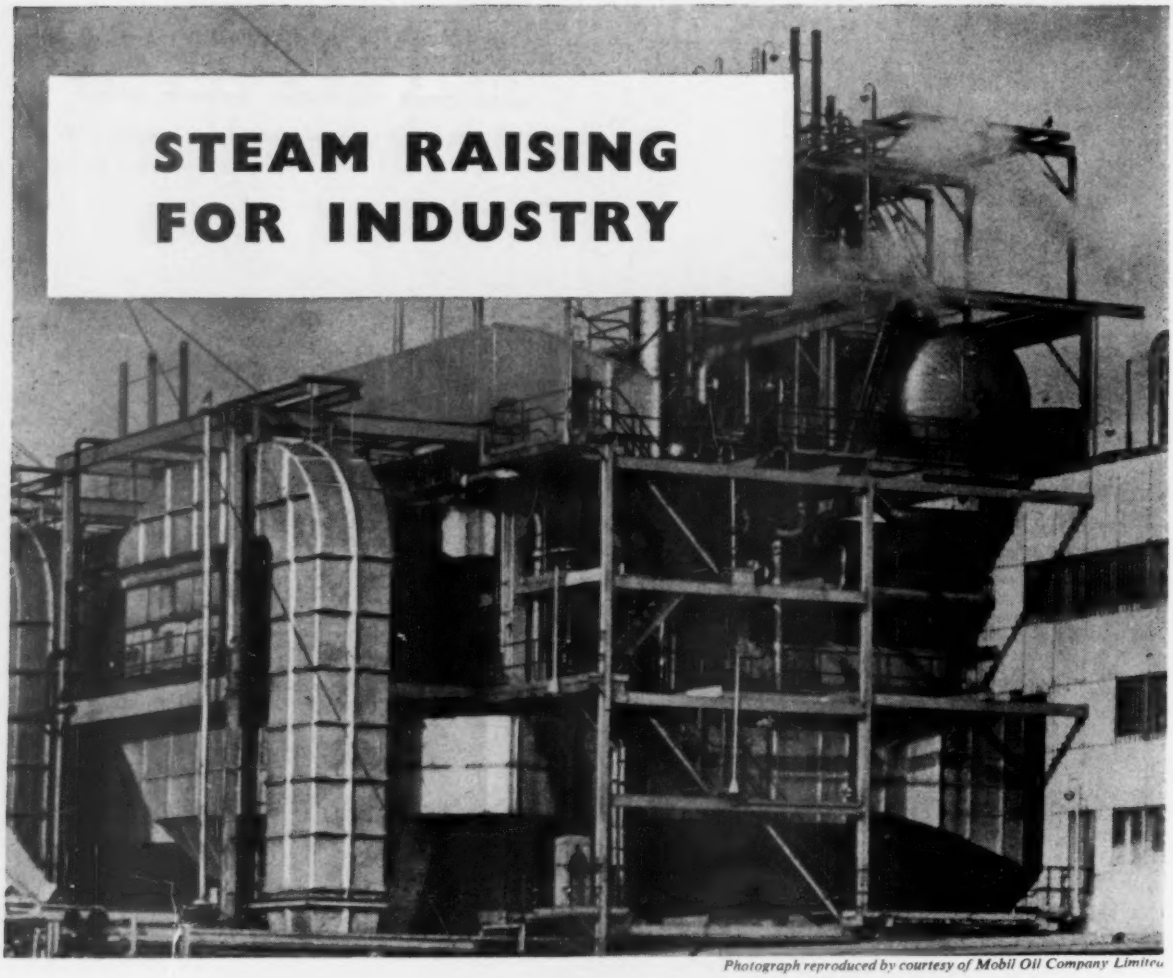
STEAM RAISING FOR INDUSTRY



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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 14 JANUARY, 1960

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Comment

"WHICH" HUNT ON HEATING?

Consumers' Association Ltd. have announced that they plan to work out what are the heating methods "most suited to the various houses, conditions and people in this country." That would be a tall order for any organisation, and it is likely to be made more difficult for CA because the Association (according to its magazine *Which*) starts with the remarkable delusion that no one has done it before. Lord Ridley and his colleagues seem to have been forgotten very quickly, and several papers to the Institution of Heating and Ventilating Engineers and others can have made surprisingly little impression. In fact, it is experience with such investigations that must give the electrical industry cause for concern at the idea of *Which* bringing its characteristic blend of enthusiasm with over-simplification to this question, where field conditions so easily invalidate results obtained even in the most fully equipped laboratories, and where the equation between cost and comfort is complicated by many imponderables. *Which* starts off this month with some conventional "cost per useful therm figures," but if later it falls into some of the traps that have ensnared earlier investigators, the effects will be the more serious because of the McCarthy-like effect of Consumers' Association utterances on the retail world. They play on the normally submerged fears of consumers that they are being tricked, and, through the Association's method of working, give manufacturers little opportunity of replying effectively to criticism made or implied in "best buy" lists and narrowly based test reports. Yet the electrical industry would be able to face the prospect of this promised guide to house heating better if it had provided some simple guide to the application of electricity in this field, arranged to answer the questions that the housewife finds arising when heating is discussed.

RESALE PRICE MAINTENANCE

With the Restricted Practices Court working effectively to destroy orderly trading, economists and politicians are currently canvassing the chances of the Government taking steps to remove the last effective remaining hold by manufacturers on retailing activities, the right to fix resale prices, written into the RTP Act. One argument in favour of this action is that it would introduce more competition in retailing and distribution, with the inference that this would mean lower prices through better efficiency at the cost of some concerns going out of business. However, those who advance this claim too easily assume that all retail goods need as little retail attention as a packet of detergent. In fact, the standard of selling and

the standard of after-sales service would both be likely to fall in the cut-throat competition between retailers to give a shade lower marked price on the product. This would be a particularly unwelcome possibility for the electrical industry, where technical service is so important. The situation became so bad in the USA, that the electrical manufacturers who had abandoned price fixing had to move in again to restore some sanity to the situation. If reports be true, that this is the formative time for a revised Government policy on price maintenance, then now is the time for the industry to make sure that the advantages flowing from the practice are as widely known as the alleged disadvantages.

DRIVE FOR SPORTS SOIL-WARMING

Icy weather in the south of the country over the weekend should have brought to sports organisation managers a sharp reminder of what many of them had seen earlier in the week—a demonstration of laying soil-warming cables in football pitches and the like, which the London EB were so enterprising as to stage in conjunction with one of the manufacturers. This technique made the headlines when it was so successful at the Everton ground a year ago, but since then relatively little headway has been made. Availability of equipment that lays the cables without too seriously disturbing the turf should help break down resistance to the technique, but, undeniably, the first cost is a big stumbling block: perhaps £2,500 for supplying and laying the cables on the pitch, and more than as much again for the electricity supply and control equipment. The total is small beside some transfer fees that are a commonplace and small besides the loss of "gates" through postponed and abandoned games in bad weather, but it is big enough to impose an unwillingness to lead the way. Two or three prominent football clubs or similar organisations planning for this anti-frost precaution may prove sufficient to swing many more into following suit, so perseverance is the necessary watchword for electricity board commercial departments promoting this development. It seems firmly established now that if insurance against frost is wanted, electric soil-warming is the most effective way of supplying it.

JUST THE JOB

Paper-making on a grand scale is the feature of the Merseyside mills we describe this week. Newsprint comes off the main mill at 25 m.p.h., and control, so that the essentially mechanically weak paper can be safely handled at this speed, is something to which modern electrical industrial techniques are particularly well adapted. Extensive use of d.c. machines with electronic or magnetic amplifiers to increase effectiveness of feedback loops well demonstrates the reliance which is now placed on once-doubted equipment. Instrumentation similarly incorporates, in its crystal-controlled master speed recording gear, techniques that were not long ago regarded as more appropriate to the laboratory than to heavy industry. Yet paper-making matches an earlier criteria of importance, large power demand, in its grinding plants, where logs are abraded to pulp. Motors of 4,000 h.p. are used to drive the grinding wheels that pulverise the wood; but again up-to-date magnetic amplifier techniques are used to keep a steady load on these, by controlling rate at which the logs are fed against them.

CABLES AND CALORIES IN FITTINGS

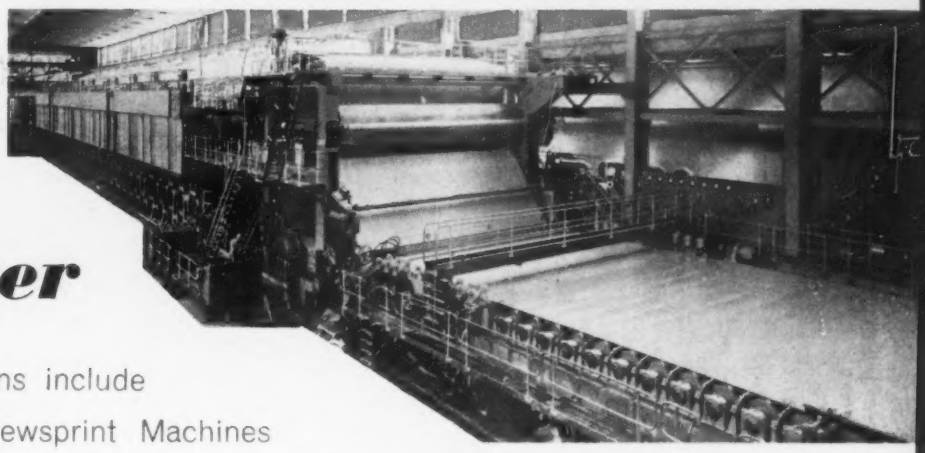
Improvements in compactness of electrical lamps are causing concern amongst installation engineers through effects on the cables in light fittings. An official statement issued by the Cable Makers' Association draws attention to the damage to cables which is likely to follow the use of a 100 W lamp in a fitting designed for one of 60 W; something quite practicable with the new lamp designs. The connecting cable will deteriorate rapidly in many cases. If vibration is present, there will be trouble relatively soon, otherwise, when an attempt is made to replace a bulb. No full solution is available so far as existing domestic fittings are concerned, although suitable cables are available, and can be used for flexibles when the trouble is recognised. Contractors are likely to collect the complaints, and they will be advised to study carefully the CMA suggestions on the topic. No doubt fittings manufacturers are already taking action on the broader design issues involved.

NEW ATTACK FROM OIL

For some time now, oil has been making the pace in the domestic heating field, and one of the principal firms has now launched a scheme which takes the full rigour of competition into the upper-middle-class market. It is the provision of oil-fired central heating and water heating on a prearranged credit scheme spread over five years, with no deposit to pay, and installation covered as well as first cost of equipment. This is an aggressive approach which will take a bite at a section of the heating market which electricity has found particularly rewarding. It is, of course, one in which convenience and comfort rate more highly than minimum cost, and these are qualities which electricity can offer to an unparalleled degree. But will the electrical industry succeed in measuring up to the new convenience of payment for equipment that the aggressive-selling, less-regulation-tied oil industry is offering? We drew attention a few weeks ago to the way competition has developed in Canada, where oil firms are offering substantial second mortgages against an undertaking to install oil-fired central and water heating. There, the gas supply authority found itself forced by commercial considerations to enter the ring with a comparable offer. Can electricity afford not to accept the challenge in this country?

Meteor

This week's quick summary of electrical news faces advertisement page 24.



Pulp to Paper

Bowater's Extensions include two 2,000 ft/min Newsprint Machines

ONE of the most advanced paper-making installations in the world has now been completed at the Bowater Organisation's Mersey Division. Extensions to the existing mill include two newsprint machines designed to produce paper at 2,000 ft/min, their associated supercalenders, and also two high-speed winders capable of rewinding paper at nearly 70 m.p.h. or faster than any similar machines existing in this country. The new plant includes a log grinding installation for wood pulp preparation using automatic control to maintain a predetermined load of up to 16,000 h.p. supplied by synchronous motors.

An inkling of the new installation's scope can be gained from its total cost; about £16 million, of which £2 million represents electrical equipment alone. Mill extensions also include a group of contemporary office buildings, and a complete factory adjacent to the main mill producing fibre containers from corrugated board.

To meet the considerable increase in power requirements of the new installations, the existing power house has been extended by the addition of a 15 MW alternator and now supplies a total of 29 MW. A further 15 MW is taken from MANWEB at 11 kV, principally to meet the grinder plant demand.

Paper Making

In the paper-making process wood and chemical pulp or sulphite are first reduced to small fibres, and diluted with water to give a solid suspension of only about 0·06%. On the paper-making machine, this suspension or furnish is dewatered and dried to give a sheet of paper, in the case of the Mersey machines 290 in. wide moving at a speed approaching 25 m.p.h. The complexity of the paper machine and its associated drive results, first, from the immense task of removing so vast a quantity of water in a short time; and, secondly, from the physical characteristics of the paper sheet. Water is removed in three stages. First, draining assisted by vacuum extraction through a fast moving wire mesh which carries the paper web on the first stage of its journey; secondly, by vacuum extraction and squeezing in three presses and finally drying, by passing the web over steam heated cylinders.

Paper is reeled up at the end of the machine in rolls 88 in. in diameter and each weighing 18 tons. These are transferred to a supercalender where the paper is given a finish which will take printing ink. Rolls from the supercalender are rewound and slit into standard diameter and width rolls ready for the printing machines on high-speed winders. During this process, any faults in the web are cut out and breaks are spliced. Newsprint from Mersey Mill supplies most of the daily papers printed in the north of England as well as a number of provincial papers.

Log Preparation

The log handling and wood grinding plant at Mersey mill is the second in the country, the previous being at the Organisation's Kemsley Division. Logs conforming to specified quality and length arrive by road and are unloaded on to a conveyor which directs them either to one of three log store piles, or direct to the barking plant, the first stage in their preparation. A flexible system of cranes and conveyors route the logs in the storage yard. These cranes are fed from sockets placed at intervals along their track and in general totally enclosed motors are used. The woodyard is illuminated for night working by three 100 ft towers with a lighting load of 100 MW.

First stage in the log preparation process is removal of bark. Logs from the storage yard are fed into a drum 15 ft diameter and 45 ft long, driven by a 150 h.p. 960 r.p.m. slip-ring motor at 6 r.p.m. As this drum rotates the logs tumble against one another and the bark rubbed off. Clean logs, leaving the drum at one end, fall on to an inspection conveyor. If the logs are not clean they return by a separate conveyor to the barking drum. Cleaned and inspected logs of standard length pass to the top of the grinder house.

Grinder House

On the top floor of the grinder house, logs are diverted on to one of a series of conveyors depending on paper-making requirements. They can pass to one of two grinder feeding conveyors, or on a further conveyor to huge water filled chests where they are stored for subsequent use. Logs directed to the grinders travel horizontally over a gate above each grinder log magazine. These gates open to accept logs as the magazine empties. Before entering the magazine, logs are aligned by motor-driven rollers to prevent jamming. The grinder house conveyor system is controlled from a central desk which has a comprehensive mimic diagram, showing the log routeing.

Fig. 1. Heading illustration shows a general view of the wet end of Number 5 machine from the control bridge

The operation of the sequence-controlled conveyor system is set up on this desk.

Grinder Plant

The mill has four log grinders, located on the first floor of the grinder house and below the conveyor floor. Each grinder has a 72 in. diameter abrasion stone formed from segments of carborundum. Logs from the magazine are forced on to these stones by motor-driven chains. The finely divided wood torn from the logs by the revolving stone is carried away in a torrent of water to be constantly agitated in large storage chests. More power is required for these grinders than in any other single process in paper-making. Each stone is driven through gearing by a 4,000 h.p. 750 r.p.m. 11 kV synchronous induction motor housed in an annexe adjacent to the grinder room, together with starting and load control panels, and control gear for certain auxiliary drives.

Control of grinder motor load and power factor constitutes a key function of the plant operating programme since it ensures that reasonable consistency is maintained in the ground-wood produced, and that the maximum demand on the MANWEB feeder, which constitutes the main power source for the grinder house, is restricted. The grinder load is not liable to sudden fluctuations. The preparation plant was designed to use baled pulp so that production of ground-wood at the mill has introduced a degree of flexibility into the electrical system since, if a fault should develop in the power house, baled pulp can be used, grinder load can be reduced and a proportion of the mill load transferred to the MANWEB feeder without increasing the maximum demand.

Individual grinder load is controlled by varying the rate at which logs are forced against the carborundum stone. The chains forcing the logs on the stone are driven by 20 h.p. fan-cooled d.c. motors forming part of a Ward-Leonard set. Each generator has a main field winding, fed from a magnetic amplifier regulator and an auxiliary bias winding. The generator main field current and therefore the chain motor speed is controlled by the regulator to maintain pre-set load on the grinder motor. Signals proportional to main motor kVA loading are obtained from voltage and current transformers. These signals are applied to a phase sensitive bridge, which resolves them into an ouput signal representing the in-phase or power component of the synchronous motor demand.

On the grinder house ground floor is a substation for the main incoming MANWEB supply to the mill. Power for the grinder motors is normally taken from this supply at 11 kV, but duplicate busbars permit load also to be taken from the mill power station. The busbar switchboard comprises ten 500 MVA units and the grinder synchronous motors are fed directly from this board. Power for auxiliary motors and lighting is obtained from two 2 MVA 11 kV/440 V 3-phase 3-wire transformers with mid-wire earthed. 3·3 kV motors are supplied from a 5 MVA transformer which also supplies the wood yard through a separate 3·3 kV/440 V substation housing a 2 MVA transformer.

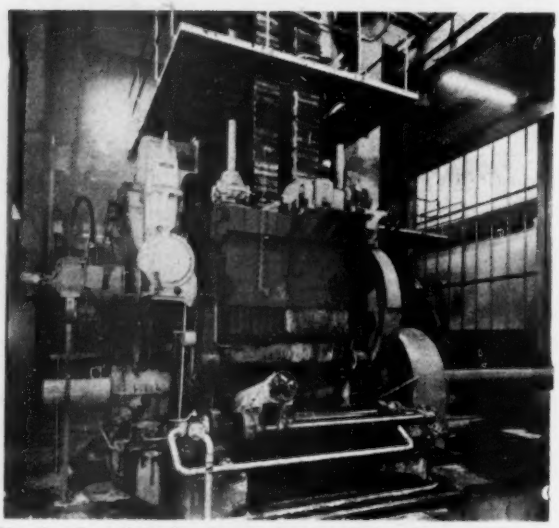


Fig. 2. One of the four log grinders installed at Mersey Mill. The 20 h.p. chain feeding d.c. motor can be seen on the left

Auxiliary motors in the grinder house total nearly 4,000 h.p., most of these are 440 V machines, but there are a few 500 and 290 h.p. motors energised at 3·3 kV. All auxiliary motors are started direct-on-line, and in general multi-motor starting panels are used with local or remote control. For convenience in a few cases local starters are used. All motors are fixed speed except for two 140 h.p. stator-fed machines driving stock delivery pumps.

Lighting in the grinder house is provided by single or twin fluorescent fittings. In the conveyor room where access to lighting fittings is difficult, 250 W mercury fluorescent lamps in angle fittings are attached to the building columns, with several additional dispersive fittings mounted above gangways only.

Preparation Plant

To provide the vast quantities of material demanded by the two new machines, a comprehensive stock preparation plant has been installed. Operation of the plant is almost entirely automatic and is controlled from a central panel equipped with a mimic diagram of the plant, remote control starting for motors, metering, and supervisory facilities. The raw material for stock preparation consists of mechanical ground-wood, supplied from either the mill grinders or an outside source and bales of chemical sulphite. These materials pass through separate hydrapulpers where they are beaten into fine fibres, then to Jordan refiners which break down any bundles of fibres present, and finally to screens where impurities and oversize particles are removed. Extensions to the preparation plant include two 20 ft diameter hydrapulpers, each driven by a 375 h.p. slip-ring induction motor and six Jordan refiners powered by auto-synchronous machines rated 400 h.p. These motors are started direct-on-line at 3·3 kV.

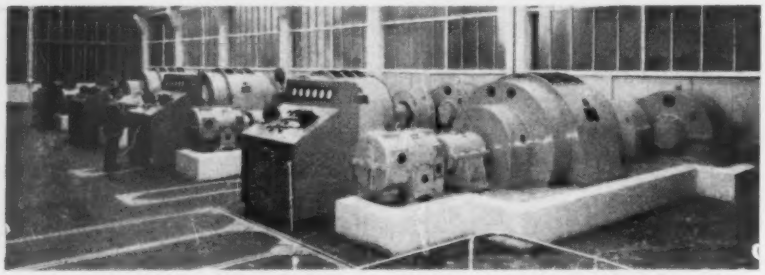


Fig. 3. The grinder motor room showing the 4,000 h.p. synchronous driving motors and their associated gear. Also illustrated are the control desks on which power-factor and load can be preset. One of the 750/290 r.p.m. reduction gears is visible on the right

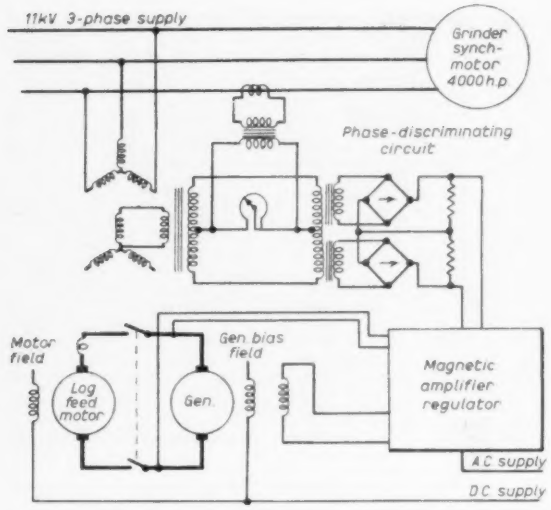


Fig. 4. Schematic diagram of the power-factor and load control circuit used for each of the 4,000 h.p. grinder synchronous motors. The log chains are driven by the Ward Leonard motor

The preparation plant has its own substation with two incoming feeders at 11 kV from each of the two paper machine substations. The substation has three step-down transformers, two rated 11/3·3 kV, 3·5 MVA and the third rated 11 kV/440 V, 2 MVA. Distribution from the substation is from an 18-panel 3·3 kV, 100 MVA switchboard remotely controlled from the preparation plant process control panel. The board supplies ten 400 h.p. synchronous induction motors driving refiners and five 375 h.p. slip-ring induction motors driving hydrapulpers, as well as other auxiliary services. The proportioners mix the various ingredients to give paper of desired consistency. After mixing and further screening the furnish, now only about 0·6% solid matter, is pumped into the flow box of the paper machine. An impression of the handling capacity of the preparation plant can be gained from the rating of the pumps feeding each machine. Each pump has a throughput of 16,000 g.p.m. against a 30 ft head and is driven by a stator fed commutator motor rated 250/190 h.p., 550/400 r.p.m.

There are two of these pumps to each machine. The first, or mixing pump, raises the dilute stock to screens through which it flows by gravity to the second, or slice pump, feeding the machine headbox.

The Paper Machines

The two new Fourdrinier machines, the fifth and sixth to be installed at the mill, are designed for a paper speed range at the calender of 900/2,000 ft/min, and their associated sectional drives for a maximum speed of 2,300 ft/min. Number five machine was commissioned in June, 1958, and is at present running at slightly above 1,700 ft/min. Although number six machine was only brought into use at the end of October, 1959, it is already running at nearly 1,600 ft/min. Speed variation between sections is limited to 0·1%, with an absolute speed variation not exceeding 0·2% of top speed.

The two paper machines are housed in a lofty machine room on either side of a central control aisle. Side aisles accommodate the machine drive motors and gearboxes, as well as enclosures for control gear and electronic panels, and machine auxiliary plant. At the wet end of the machine room are the final stages of the stock preparation and proportioning plant and the flowbox for each machine for regulating the rate and distribution of furnish on the Fourdrinier wire. At this point a flying control bridge spans the central aisle. This bridge houses machine speed controls, supervisory and recording equipment for the multitude of operations involved in making paper and speed recording equipment. The two Fourdrinier machines comprise a wire part, pick-up and wringer rolls, three press sections, three drier sections with a total of 63 cylinders, a machine calender and finally the reel.

A break occurring in the paper sheet at it passes through the machine is detected by photelectric equipment and immediately the sheet is cut by a water jet at the wire. All scrap paper from the machine, supercalender and winder is collected in vast pits in the basement and, after treatment, returned to the proportioner.

Lighting in the paper machine room is provided by 138 blending units, each housing a 750 W tungsten and a 400 W mercury vapour lamp. The lamps operate at 440 V, 3-phase 4-wire, and are mounted in the false roof of the machine room which also carries hot air ducting and

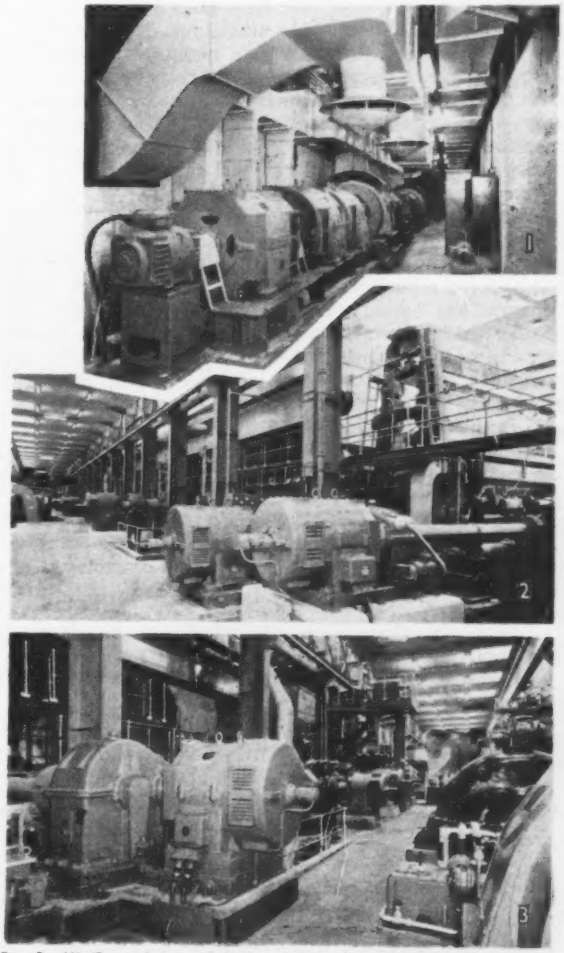


Fig. 5. (1) General view of the basement substation showing Number 5 machine m.g. sets. The air extraction system is also shown

Fig. 6. (2) Rear of Number 5 machine. In the foreground are the reel and machine calender driving motors. In the background the control gear structure and dryer section motors can be seen

Fig. 7. (3) Drive motors and gearboxes looking from the dryer section towards the wet end of Number 6 machine

other services. These lamps provide an illumination level of 17 lumens/sq ft. Most of the remaining lighting in the mill is obtained from 5 ft fluorescent reflector tubes operating at the mill voltage of 110 V with centre point earthed.

Machine Drive and Auxiliaries

Because in the early stage on its journey along the machine the paper web has little mechanical strength, while after the first drying sections it has some mechanical strength but little ability to stretch, it is essential that there should be negligible speed variation between the different machine sections. Each of the 12 main sections of the machine is driven by a Ward-Leonard set with the generator field regulated to maintain the motor speed at a constant value with reference to a preset reference speed. Control of generator field current is effected by an electronic amplifier which responds to changes between the fixed speed reference signal, and a signal proportional to motor speed derived from a tachogenerator driven by the section motor. Accuracy of the system turns on the stability and freedom from drift of the tachogenerators and the reference source. The tachogenerators are permanent magnet machines with monel metal commutators and silver graphite brushes which minimise variations in their output. The reference for all the sections is obtained from a motor-operated high accuracy potentiometer energised from a stabilised power pack. Changes in paper machine speed, effected by varying the reference, are sufficiently gradual to ensure that sections with widely different inertias accelerate at the same rate.

An unusual feature of the Mersey machines' electrical equipment is the enclosure of all regulating and contactor gear in a ventilated structure. This structure, located in the paper machine side aisle, has external current indicating meters for each drive section. Unauthorised access to the regulating equipment and open contactor panels is prevented. The enclosure also contains testing panels independent of the machine drive for checking electronic regulators, and instruments for recording machine speed and draw between sections.

On number six machine, the generator field currents are controlled by magnetic amplifiers in contrast to the thyratron valves used on number five and similar machines previously installed. Operating in conjunction with a hard valve amplifier, it is expected that the magnetic amplifier will give longer life than the thyratron control system. Power for the different d.c. motors driving each machine section is supplied from multi-generator m.g. sets housed in similar basement substations. There are two of these sets for number six machine, each driven by a 1,700 h.p. synchronous motor.

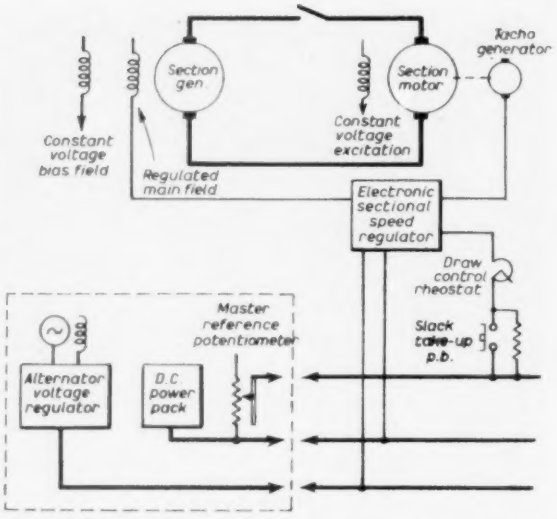


Fig. 8. Schematic diagram of the d.c. Ward Leonard electronic speed control system used for each paper machine section motor. Thyratron regulators have been used on Number 5 machine, and magnetic amplifier regulators for Number 6

Any fault in the drive necessitating a shut-down of the paper machine involves loss of production at the rate of several thousand pounds per hour. Every precaution must be taken to correct faults as soon as they arise and for this reason spare regulators, which can be brought into service, are included in the machine regulating enclosure and spare armatures are available for all section generators and motors. To reduce the number of spares necessary, every effort is made to limit the number of different motor horse powers specified for the drive and to apportion the machines to generator sets so as to permit the same size of drive motor to be used.

The machine substation is forced ventilated to remove the considerable heat dissipated by the m.g. sets. In addition to the sectional drive m.g. sets, it also houses motor generator and amplidyne regulator sets for the supercalender and winder and also their control panels. Each paper machine requires about 7 MW and this is brought in from the mill power house to 10- an 9-panel, 500 MVA switchboards in the numbers 5 and 6 substations, respectively. Also in the basement substations are 2·75 MVA transformers supplying 440 V for machine auxiliaries, through air-break 30 MVA switchboards. These

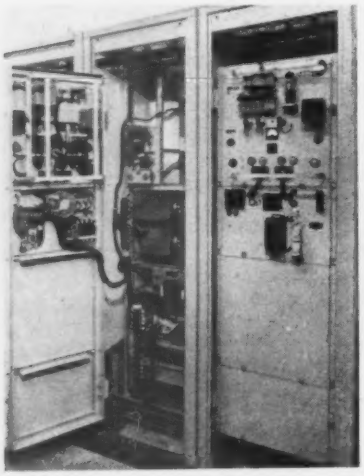


Fig. 9. One of the electronic control cubicles showing layout and construction

No. 6 MACHINE DRIVE DETAILS

No. 6 Machine Drive Point	Control	Motor h.p.	M.G. Set	Rating	
Couch	Speed	750	Generator	600 kW	
1st under wire roll	Helper	20	—	—	
—	—	—	Synch. Motor	1,700 h.p.	
Pick-up roll	Helper	50	—	—	Wet end
Wringer	Helper	150	Generator	440 kW	
Transfer press top roll ...	Helper	50	—	—	
Transfer press bottom roll ...	Helper	300	Generator	200 kW	
2nd press bottom roll	Speed	300	Generator	440 kW	
—	—	—	Synch. Motor Excr.		
3rd press bottom roll	Speed	300	Generator	200 kW	
1st dryer	Speed	550	Generator	440 kW	
2nd dryer	Speed	550	Generator	440 kW	
—	—	—	Synch. Motor	1,700 h.p.	
3rd dryer	Helper	550	Generator	440	Dry end
Calender	Speed	550	Generator	440	
Reel	Speed	150	Generator	200 kW	
—	—	—	Synch. Motor Excr.		

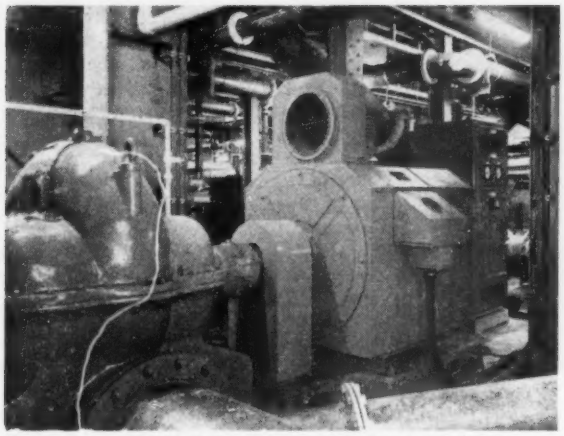


Fig. 10. A.c. motor driving a mixing pump. This is a 250 h.p. stator fed machine, with a 550/440 r.p.m. speed range

panels in turn supply h.b.c. fuse switchboards for sub-main distribution.

Machine Controls

Each machine has three operator control stations located in the central aisle between the two machines where the more important electrical, hydraulic and pneumatic controls are grouped. There are also several other control points located at different parts of the machine including starting stations for the couch and dryer sections.

Overlooking the wet end of both machines is a flying bridge. Supervisory and monitoring equipment mounted on this bridge includes a high accuracy section speed indicating system developed by the Bowater Organisation, and overriding speed control.

The speed indicating equipment is operated by impulse generators, each consisting of a toothed steel wheel rotating in a magnetic field, and driven from each section of the machine. Impulses from these generators are applied to a gate circuit and fed to dekatron counters which control digital display valves giving the machine speed directly to high accuracy. Adjacent section speeds can be observed simultaneously on the equipment. The circuit is controlled by a 10 kc/s crystal standard.

Desk controls include section motor ammeters—it is worth noting that hermetically sealed platform scale instruments are used throughout the installation—section starting switches, and meters and control switches for draw indication and control. Sections of the machine can be accelerated from rest to either crawl or run speed from these desks. The rate of acceleration is determined by a capacitor discharge circuit in each electronic regulator. This simple starting circuit dispenses with individual section accelerating potentiometers. On the three drying section and also on the calender section there is provision to run in reverse at reduced speed for clearing paper and adjusting felts. These high inertia sections also use dynamic braking to bring them quickly to rest when the machine is shut down.

An innovation on the new machines is the inclusion of a high accuracy system of draw measurement. Draw is the term used for the preset difference in running speed between adjacent machine sections. This speed difference stretches the paper web at the wet end of the machine and knowledge of the exact amount of stretch, especially on a high speed machine is essential for the paper-maker. A differential selsyn system is used for draw indication and measurement. Each of the paper machine section gearboxes drive, through a toothed rubber timing belt, a three-phase transmitter selsyn. The ratios of the toothed belt pulleys are selected so that selsyns coupled to different sections rotate at the same speed, provided the peripheral speed of their associated machine rolls are the same. Output from adjacent section selsyns are fed to a differential selsyn which in consequence rotates at the difference in speed of the two sections.

Each differential selsyn is coupled to a high accuracy tachogenerator and the output voltage of these tachogenerators, proportional to the difference in section speeds, operates draw indicating meters and recorders. Because the differential selsyns rotate at the difference in speed between two sections, errors in the system are limited to a percentage of this speed difference and not to a percentage of the actual machine speed, in consequence a very high accuracy of indication results. Provision is made to inject into the tachogenerator circuit a signal proportional to machine speed to compensate for subsequent change in roll diameter after machining. A spill-over circuit prevents damage to indicating equipment when a section is running without its complementary section.

The draw control system enables the operator to vary a given section speed independently of the speed of its adjacent sections, or to change the speed of a given section and all the preceding sections by the same amount.

Auxiliary Services

Although the paper machine drive is the most complex and spectacular part of the mill installation the auxiliary drives are also impressive. There are no less than 583 auxiliary motors in the machine room and preparation plant with a total rating of 22,139 h.p. The majority of these machines are squirrel cage t.e.f.c. machines to BS 2083, but notable exceptions are two 1,400 h.p. wound rotor motors which power Sulzer blowers. These blowers have a total capacity for each paper machine of 52,000 cut ft of free air per minute. Their function is to extract air from the wet end vacuum boxes and the press sections. There are also a number of small, remotely controlled stator-fed variable speed motors.

Considerable thought has been given to control and starting of the numerous motors. In general, group starting has been employed throughout the mill, and in the machine building there are 37 multi-motor switchboards arranged for local and remote control. Every motor so controlled has an ammeter and indicating lights at either the main control bridge or at one of the numerous auxiliary control desks and stations. Each motor also has an adjacent stop/lock switch for safety purposes.

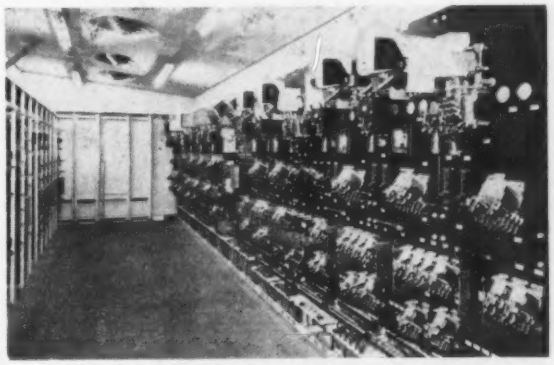


Fig. 11. Internal view of the control gear structure. The electronic panels face the control gear and can be seen on the left

Supercalender

Completed machine reels are transferred by overhead electric hoists to the supercalender where finish is imparted to the paper, and then to the winder for reeling and slitting into standard newsprint reels. Supercalendering and winding are discontinuous operations and are carried out at speeds considerably higher than paper-making speed to keep pace with the machine output. The two new supercalenders have a speed range of 500/3,300 ft/min and the winders 100/6,000 ft/min.

A departure has been made from normal practice in locating the supercalender unwind and wind-up reel stands on either side of the vertical nine roll calender stack, to speed operation of the process. These two sections of the supercalender are driven by d.c. motors fed in parallel with the main motor from a single generator, through boosters. The boosters are controlled by an amplidyne regulating system which maintains tension in the paper sheet on both sides of the supercalender roll stack at a predetermined value when the machine is running at constant speed, and also during acceleration and deceleration. A similar system has been used for the winder and will be described in greater detail in a later reference. The main supercalender stack consists of chilled iron rolls running against compressed woollen paper rolls with pneumatic compounding capable of exerting a pressure on the bottom roll of 1,000 lb per inch width. The high frictional power absorbed in the stack is provided by a 750 h.p. 750 r.p.m. d.c. motor driving through reduction gearing. When paper is being threaded through the supercalender, a constant speed of about 50 ft/min is maintained by a separate 60 h.p. induction motor driving into the main gear box. This drive also provides the high initial breakaway torque required and is automatically disconnected through an overrunning ratchet-clutch when the main motor accelerates; at the same time the barring motor line contactor opens. Lifts are provided on both sides of the supercalender stack to assist operators to thread paper between the rolls.

The unwind and wind-up reel stands are powered by 60 and 90 h.p. motors, respectively. As already stated, the armature current of these machines is controlled by series boosters to maintain tension in the paper sheet constant during acceleration and deceleration. The high stored energy in the unwind and wind-up reels is dissipated during normal deceleration by causing the two reel motors to regenerate. A paper break, occurring while the supercalender is running, is detected by photoelectric equipment which brings the emergency stopping sequence into operation. Under an emergency stop, the main drive motor is braked to rest regeneratively and the wind-up reel dynamically. To dissipate stored energy in large reels which may be up to 88 in. dia. on the unwind side, dynamic braking is augmented by thrustor operated friction brakes when the reel exceeds a certain predetermined diameter. Operator's controls are grouped at a desk overlooking the wind-up reel. They include inch, run and accelerate switches, speed and current indicating meters and tension control rheostats. The supercalender is supplied by a 600 kW d.c. generator driven by a 850 h.p. synchronous induction motor. The controlling amplidynes and boosters are grouped together on a separate set.

MAIN ELECTRICAL CONTRACTORS

A.E.I. Ltd.	Drive, reduction gearing and controls for the paper machines, supercalenders, winders and grinding plant; motors for mixing pumps, sulzer blowers and auxiliaries; 440 V main and auxiliary switchgear; cables.
A.E.I. Lamp & Lighting ...	Outside lighting: Fluorescent fittings.
Allen West	Single- and multi-motor control panels; sulzer blower controls.
Babcock and Wilcox ...	Main contractors for boilers and associated plant.
Bailey Meters & Controls	Boiler instruments and controls.
Balmos	Single- and multi-motor starters and control-gear.
B.I.C.C.	Cables.
Brush Elect. Co. Ltd. ...	10 MVA transformers.
Contactor Switchgear ...	Boiler house 440 V contactor gear.
Crompton Parkinson ...	Motors for refiners, hydrapulpers, compressors and cranes: lighting fittings.
Davidson & Co. Ltd. ...	Boiler fans; dust collectors.
Dawhurst & Pears. ...	Control gear.
Dowrance & Co. Ltd. ...	Valves and fittings.
Drysdale & Co. Ltd. ...	Cooling water pump.
Ekco Ensign	Fluorescent fittings.
E.C.C.	Packaged m.g. sets.
G. Ellison	3·3 kV switchgear.
Electronic M/c Co. Ltd. ...	Dekatron speed indicators.
Enfield Cables Ltd. ...	Cables.
English Electric Co. ...	Pump fan and auxiliary motors; fuse switchgear and distn. boards; overhead busbar trunking.
W. T. Glover	Cables.
G.E.C.	Lighting fittings; 4 MVA transformer.
Hartons Ltd.	Control panels.
Hopkinson Ltd.	Steam valves.
J & P	2 and 2·75 MVA tfrs; cables.
L. D. Nevslin Ltd. ...	Mercury arc rectifier drives.
Lindley Thompson ...	3·5 MVA tfr.
London Tfr. Products ...	5 MVA and smaller tfrs.
Laurence Scott	Variable speed motors.
Mather and Platt	Pump motors; pumps.
Mersey Cables	Multicore and control cables.
Nalder Bros. & Thompson	Instruments.
C. A. Parsons	Turbo-alternator; feed heaters.
Philips Electrical Ltd. ...	Lighting fittings and fluorescent tubes.
Printing & Paper Drives ...	Corrugator and rewinder drives; cross cutter and headbox controls; multi-motor panels; A.C. commutator motors.
Pyrotenax	Mineral insulated cables.
Record Electrical	Instruments.
S.T.C.	Control Cables.
Simplex Electrical ...	Roof lighting fittings and woodyard floodlights; 110 V distn. boards.
Switchgear & Cowans ...	11 kV Switchgear; 3·3 kV switchgear and control panels.
Tanjon (Newcastle) ...	Main electrical contractor.
J. Tate	Soot blower controls.
Telephone Rentals Ltd. ...	Telephones and fire alarms.
Transformers (Watford) ...	Transformers 1·25 & 1·75 MVA.
Tubewrights	Wood-yard lighting towers.
G. & J. Weir	Feed pumps and auxiliary boiler plant.

Winder Drives

Although the drive for numbers 5 and 6 winders are similar electrically, the mechanical construction of the machines differs in a number of respects. Number 5 winder was manufactured by Beloit and number 6 winder was built by Walker Bros. and is one of the largest made by a British manufacturer. The winding process consists in unwinding machine reels received from the supercalender under controlled tension, slitting the sheet into standard widths by rotating shear knives and rewinding the paper into finished reels by contact with two motor-driven drums. The rewound reels have a maximum diameter of 42 in. The friction drive is maintained, partly by weight of the reels as they build up, and partly, while still of small diameter, by a roll which rides on top of the finished reel moving up as its diameter increases. This rider roll is driven by two 7½ h.p. motors energised from a main generator through a series booster. The operator's control desk is positioned to enable him to watch the sheet of paper as reeling progresses and it is equipped with controls similar to those provided on the supercalender control desk. The machine has guards fully interlocked to prevent access when the speed has risen above about 100 ft/min.

The two winder drums are each driven by a 180 h.p. d.c. motor. One of these motors has a short field weakening range allowing torque exerted by the two motors on the finished reel to be varied slightly to assist tight winding. The two main motors are energised from a 230 kW generator which also feeds the unwind reel-stand braking generator through a booster. This centre-driven unwind reel is powered by an 87 h.p. braking generator and is also equipped with two thrustor-operated brakes for quick stopping, as on the supercalender. If a paper break occurs these brakes assist dynamic braking on the braking generator in bringing the reel to rest quickly. The main winder drums brake regeneratively.

With the winder running at a fixed speed, the main generator voltage will be steady and constant tension will

be obtained in the paper sheet if the braking generator armature current is also maintained constant. Braking generator armature current is maintained constant by an amplidyne-controlled series booster in conjunction with a field weakening rheostat in the braking generator field circuit. This rheostat is moved by a pilot motor in a direction to weaken the field as the speed of the braking generator rises with decreasing parent reel diameter. At constant paper speed, the booster terminal voltage should only be sufficient to overcome IR drop in the armature loop.

Three amplidynes are used in the control system. A speed control amplidyne which regulates main generator field current so as to maintain a preset drive speed, a tension control amplidyne which regulates booster field current to maintain the required tension in the paper sheet, and an inertia compensation amplidyne which comes into use only during acceleration and deceleration and which injects an overriding control signal into the tension control amplidyne circuit. The control circuit associated with the speed regulating amplidyne enables a constant crawl speed of about 100 ft/min to be maintained, acceleration to be controlled, and current limit to be applied to the main motors during regenerative braking. The tension control amplidyne performs two functions. When the machine is running at speed it regulates braking generator armature current and therefore tension in the paper sheet, whilst when paper is being threaded through the winder the regulator is used as a voltage rather than current regulator to maintain the rotational speed of the parent reel constant. During threading, the thrustor brakes on the unwind stand are used to prevent excessive slack paper being unwound from the parent reel.

A third amplidyne, operating in conjunction with the tension control amplidyne, varies braking generator armature current during acceleration and deceleration to compensate for the change in parent reel inertia with its diameter, and so maintains constant tension in the sheet. The output of this amplidyne is determined by a signal obtained from the armature current of the main motors which gives a measure of the total power required to accelerate or decelerate the winder. Before the inertia compensation amplidyne output is applied to a field on the tension control amplidyne, it is modified by a rheostat whose position is governed by the parent reel diameter. This rheostat is driven by the pilot motor which also controls the braking generator field rheostat position.

The single paper sheet unwound from the parent reel is cut on the Beloit winder by rotating slitter knives, individually driven by 1 h.p. d.c. motors. On the Walker winder, the knives are on a common shaft, driven by a 12 h.p. motor. Power is supplied by a separate m.g. set comprising a 12 kW generator driven by a 17½ h.p. induction motor. These knives run at a speed slightly in excess of the paper speed to ensure clean slitting.

Auxiliary control circuits which include hydraulic reel ejectors, guard lifting motors and oil pumps are fully interlocked with the main winder drive. The winder

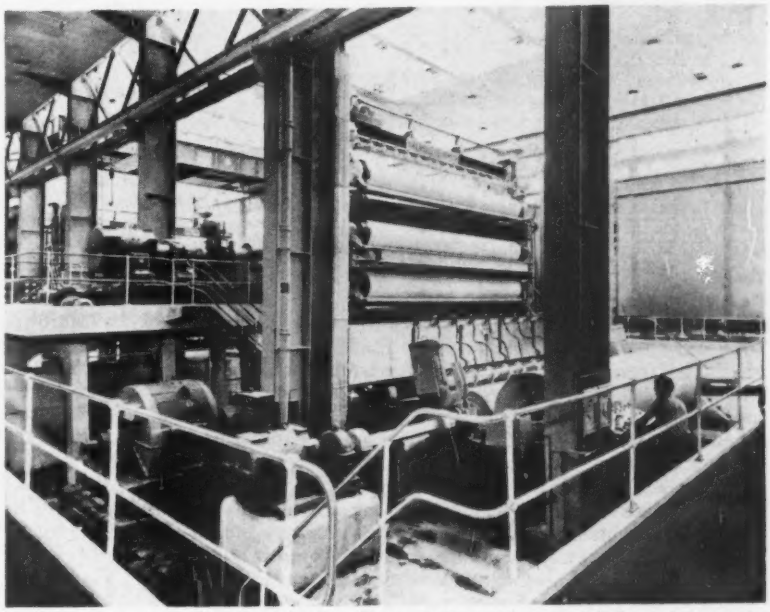


Fig. 12. Number 5 machine supercalender. Clearly visible are the control desk, wind-up motor, main 750 h.p. motor and the unwind stand braking generator. The wind-up reel is surface driven and the unwind reel, which may be 88 in. dia, is centre driven

m.g. set and its associated amplidyne set are housed in the basement substation with the paper machine and supercalender m.g. sets. Each winder drive m.g. set includes a 12·5 kW booster, and an additional booster for the rider roll motors. It is driven by a 260 h.p. 440 V squirrel cage induction motor. Winder and supercalender control gear is housed in the basement substation.

Conclusion

In planning and specifying electrical equipment for the Mersey mill extensions, Bowater's engineers have had to use considerable foresight in obtaining equipment complying with the prime requirement of being quickly replaceable in the event of breakdown. Standardisation has been implemented wherever possible in motors, control switches, meters and many other features of the installation. Cabling has been standardised throughout the mill and runs on carefully planned racks and trays. For the majority of the lighting installation and for a.c. motors up to 60 h.p. rating m.i.c.c. cable with a maximum core size of 0·03 in. diameter has been used. For motors above 60 h.p. and for current ratings requiring up to 0·2 sq in. conductors, aluminium sheathed paper insulated cables are installed; p.i.l.c.s.w.a. is used for the larger current ratings and for all 3·3 and 11 kV work.

The new three-storey administrative block is lit by a combination of tungsten and fluorescent lighting and includes an extensive GPO PABX and private PAX telephone system covering the whole factory.

The mill electrical installation was planned and supervised by the Engineering Division of the Bowater Organisation under its chief engineer, Mr G. R. Roberts, M.I.M.E., and the electrical engineer, Mr A. C. G. Witts, B.SC.(ENG.), A.M.I.E.E. Ewbank and Partners were the electrical consultants for the mill offices and for most of the power station extensions. These will be described in a further article. Architects for all building work were Messrs. Farmer and Dark. *(To be concluded.)*

Power system protection

I.E.E. SECOND HUNTER MEMORIAL LECTURE

ADVANCES in the protection of power systems against faults were reviewed by Mr H. G. Bell (consultant, R. Gregory & Partners, formerly chief engineer NWEB) in the second Hunter memorial lecture to the Institution of Electrical Engineers, delivered in London last week. Mr Bell, in keeping with the object of this lecture, offered a broad survey at a level to interest non-specialist engineers, and placed the accent on historical development to match growing size of power systems. In his introductory remarks, he pointed out that although many regarded the late P. V. Hunter as a cables engineer, he used to think of himself as a general engineer, and protection was something in which he had a special interest.

Protection Fundamentals

Searching at the foundations of his subject, Mr Bell made the point that it was not gear that might become faulty that was "protected"; rather it was the rest of the system to which that equipment was connected. The public regulations binding on supply authorities in this country required that a system should be so sectionalised and arranged "as to restrict within reasonable limits the extent of the portion of the undertaking affected by any failure of supply."

Early in the history of power engineering, the lesson was learned that if good protection were not provided, there had to be extensive duplication of circuits. In general, protective gear was less expensive than that duplication.

In the course of a review of the types of protective equipment used, Mr Bell offered a number of general observations based on his experience. For instance, he emphasised the need for every protective relay to be provided with some sort of indicator to show when it had operated. This could be of the greatest value in reconstructing complicated faults after they had cleared.

Another topic on which the lecturer was emphatic was current transformers. When used in protection circuits they had to fulfil conditions far different from those in measurement circuits, and this was not always realised. Whereas a measuring c.t. had to maintain its characteristic only up to about 120% rated full load of the circuit with which is was associated, a protection c.t. had to remain reasonably linear up to about 30 times full load. The secondary currents differed, as well. Although the usual 5 amp had been satisfactory in the early days, as switchgear became physically separated by considerable distances, this value came to impose a very heavy burden on protection c.t's. Today a 1 amp secondary current was usual.

After the survey of protective equipment came a similar broad-sweeping look at protective systems, including an ingenious demonstration of distance protection on the zone principle as applied to the British Railways 25 kV electrification schemes. Mr Bell added a reminder that there were methods of protection other than the straightforward techniques of relays operating circuit-breakers, or direct-acting fuses. He instanced Petersen coil earthing, and fault-throwing to bring out the distant protecting switchgear in the case of transformer feeders when faults occurred on the l.v. side. He also mentioned the shunt circuit-breaker principle, in which there were three circuit-breakers connected between phase and earth on a three-phase system. If a single-phase earth fault occurred, for example, the appropriate circuit-breaker closed for a short while, placing a very low impedance across the fault. If the fault were transient, the arc extinguished because of insufficient voltage to maintain it.

Speed and Reliability

As power systems grew in complexity, it became necessary to provide increasingly rapid operation of protective gear in order to maintain stability on systems under fault conditions, and to prevent extensive damage.

The table shows how speed of operation has increased:

Table I. Speed of Operation of Protective Gear

Year	Type of Protection	Time to operate—cycles
1915	Overcurrent	50
1925	Distance-time	25
1936	Lock-in carrier	8
1942	High-speed lock-in	5
1950	Contraphase	1-2

Today it was possible to clear a fault within about one-tenth of a second of its occurrence. However, fast operation brought problems in that transient disturbances were still occurring, making the task of protective gear and of switchgear more difficult. Stability was demanded of protective gear with through currents of 30 to 40 times full load flowing through healthy sections of transmission systems. This condition generally required some sort of bias to provide stability. It also meant that much information had to be obtained about systems to be protected, typically by network analyser or digital computer studies.

When faults occurred, it was an advantage to be able to analyse the sequence of events afterwards. Some sort of memory device was needed, and Mr Bell described the oscilloperturbograph, in which there was storage continuously for about $\frac{1}{2}$ to $\frac{3}{4}$ second. This gave time to detect a fault and arrange for the stored information (on an oily drum) to be transferred to permanent record form before it was erased. The device could record 7 transient values and give 12 "on-off" indications.

Protective gear could give a remarkable high performance. Since the early days of the Central Electricity Board, records have been kept of all incidents causing operation of protective gear. If *every* relay and switch operated correctly, then the incident was adjudged a correct operation. In 1934 the proportion correct was 80%. This rose to about 90% in 1940, and 95% in 1947. The figures then dropped because the statistics were extended to include power station switchgear, but even on this basis, they were now back to 90% to 92%.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Christmas Illuminations

THE warning issued by *Megohm* recently regarding Christmas illuminations in the home might well be extended to include public supply and other authorities. I know of a town where a Christmas tree was erected in a main thoroughfare, exposed to the elements (and it certainly poured for days on end!), with many of the lamps within easy reach of children and adults, but with exposed metal lamp caps.

A sight to make an electrical engineer shudder—but I must add in all fairness that a letter from me to the appropriate authority produced action within 48 hours, rubber sheaths being fitted over the offending lamp caps. Fortunately for all concerned, no fault had developed during the many days previous, most of which were wet.

R. St. C. Ison,
CHELTENHAM, GLOS.

Water-heater Connections

IF Mr Hodgins refers to my letter (10 December) he will find that I did, in fact, state that the present design of heater head is unsatisfactory. Its main deficiency is the absence of any provision of support for the cables passing to it. If the heater head was constructed so that it had a tapping to receive ¾ in. screwed conduit, a variety of means of dealing with the matter would be available. The connections could then be made, by cables in conduit, by m.i. cables using suitable fittings, or by means of asbestos-covered cables, using a suitable screwed-lead adaptor as a clamp.

If the object of Mr Hodgins proposal for more robust terminals is to provide a stronger hook on which to hang the cable connections, I am not in favour of it. Many water-heater connections already contravene the spirit of Regulation 207A, which requires that conductors shall not impose an appreciable mechanical strain on the terminals.

The proposal for "cold tails" does not strike me as desirable either. How is the thermostat to be connected? Also floor-heating connections are not installed in a cupboard where they are likely to have objects dropped on them.

For preference I would like to see water-heater connections completely enclosed in some form of rigid connection. They would then be free from damage caused by having objects dropped on them or rammed against them. This would involve the use of conduit or m.i. cable carried right into the heater head. Such a type of enclosure is highly desirable where the tank is in the bathroom.

Where unprotected asbestos cables are used as an alternative it is desirable that such connections should be made in a compartment exclusively used for that purpose. Such a compartment can be formed of asbestos; this material is fireproof. Such cables should be properly supported.

The tightening of connections to compensate for differential expansion is a recognised practice with many engineers and plumbers and there is good theoretical support for it. The necessity of taking precaution to prevent loosening arising from differential expansion is not confined to the heating world.

We have another example of such precautions being necessary in electrical installation, which occurs on a much smaller temperature range than that experienced on the terminals of an immersion heater. When conduits and fittings of steel and aluminium and zinc base alloys are used in conjunction, movements within the joints can occur with changes of temperature, unless precautions are taken to combat them. The reason for this is that the difference between coefficients of expansion of steel and aluminium and zinc-base alloy is much greater than the difference between the coefficients of expansion of copper and brass. For this reason, where steel and aluminium and zinc-based alloy conduits and fittings are used together, it is necessary to provide lock-nuts on all joints. This is required by Regulation 220, Note 2, paragraph 2.

The screws in the immersion-heater connection could not be considered to be correctly tightened unless tightened at maximum temperature.

A. R. Gascoigne,
LONDON, N.15.

Cooker Circuit Terminations

MR. PENWILL'S recent letter is a welcome recognition of a situation which has been growing up in the industry almost unawares. While the ECA is dealing with the problem of 60 amp control units for 50 amp cookers, there is another aspect of the same problem which also needs urgent attention; cooker terminals. For far too long it has been a practice to provide cookers with terminals at the rear, designed for the acceptance of bare cable ends wrapped around a screw pillar and clamped between nuts and washers. This might be a reasonably satisfactory termination for 10 or 15 amp appliances, but is wholly inadequate for a 40 or 50 amp cooker. Who, may I ask, would seriously consider connecting up a 40 h.p. motor without proper cable lugs? Yet a 10-12 kW cooker needs at least a 7/048 conductor and a fairly straight entry to the terminal box. Cooker designers should give this their immediate attention. As I have recently spent more than ¾ hour endeavouring to make a satisfactory termination to a 1960 design cooker, trying to bend the cores of a 3-core 7/048 cable twice at right angles and wrapping them round an awkwardly placed set of terminal pillars whilst on my knees—a job which, properly engineered, should only have taken five or six minutes—I think I may justifiably sign myself,

"Livid".

Organic Semi-conductors in U.S.S.R.

REPORTS from the USSR claim that organic polymers giving electrical semi-conductor properties have been developed by the Academy of Science's Institute of Oil-Chemical Syntheisis. The report states that the first synthetic polymer semi-conductor was polyacrylonitril, a substitute for wool. It became an electrical semi-conductor after exposure to ionising radiation. Another semi-conductor is claimed to have been based on a combination of the same material with siloxane.

In favour of polymer semi-conductors, it is claimed that they can be processed more easily, and are more stable than germanium and silicon. Also, there are no supply problems. Available reports, however, give no indication of the electrical characteristics of the new materials.

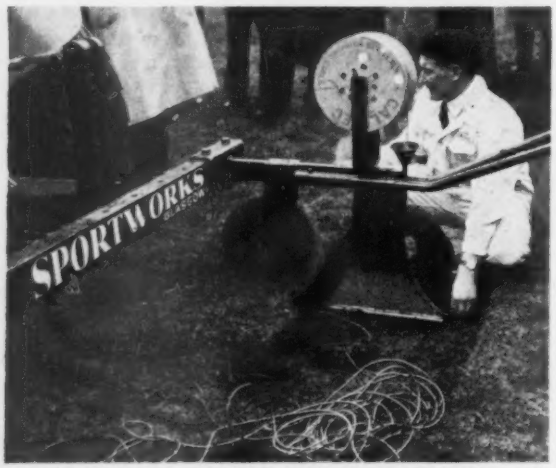
Tractor cable laying for sports ground soil-warming

A SPECIALLY-DESIGNED mole plough makes it possible to lay soil-warming cables in football pitches and the like without serious disturbance to the turf. This development was demonstrated to football club managers and others with a commercial interest, in London, last week. The London EB, in collaboration with Calidec Ltd., the manufacturers, staged the demonstration at the Raynes Park sports ground of the LEB.

Mole Plough

The general arrangement of the mole plough can be seen from the illustration. A wheel in advance of the plough cuts the turf cleanly, while the share is arranged to carry the heating cable at its rear end. The cable is started off from a prepared shallow pit at the end of the ground in which it is being laid, and the operator guiding the plough gives a preliminary treading-down to the disturbed turf as he follows the towing tractor. On the return run, the tractor wheels largely complete replacement of the turf. The mole plough is mounted on a variable-fixing tow bar for attachment to any standard agricultural tractor provided with hydraulic equipment. In the demonstration, the cable was laid at 6 in. depth and with each wire 6 in. from its neighbour. This has become the standard spacing for this type of work. Experiments conducted by the Sports Turf Research Institute, Bingley, Yorks, have indicated that a satisfactory performance is obtained when soil-warming cables are laid at this depth and spacing with electrical loadings of 10 W/sq ft.

Altogether, some 2,200 yd of cable were laid in the demonstration, covering an area 60 yd long by 6 yd wide. The cable used was p.v.c.-insulated, with a stranded steel alloy conductor. It was jointed and hermetically sealed to cold tails of stranded flexible copper cable, provided with double-thickness p.v.c. insulation. It is intended that the LEB shall connect the heating cable to their supply and carry out tests during frosty weather.



Mole plough arranged for cable laying about to begin a run. The cable is fed through the rear of the share and the turf is returned tidily above it once the cable is in position

Costs

Actual cost of supplying and laying the heating cables only, in the manner demonstrated, would be about £2,250 to £2,500 for a full-size football pitch. To this would have to be added the cost of the electricity supply and the control equipment, which would be considerable. It is estimated that with the tractor under control of a first-class agricultural driver, with an experienced cable layer in attendance, the laying operation would be completed in about ten working days. The standard of replacement of disturbed turf is such that the pitch concerned should be usable during this time. Total installed load for a football pitch would be of the order 650 to 800 kW; it can conveniently be supplied on an off-peak tariff.

The usual control arrangement with soil-warming frost protection of this type is that the installation shall be switched on in sections. For example, when air temperature falls below 36°F, one-third of the total installation might be switched on. As the air temperature approaches closer to freezing point, the total installation is brought in to maintain the pitch in playable condition. Assuming 1d per unit as a representative off-peak rate, the running cost is about £3 5s per hour.

Advantages

When considering this figure, and the sizeable capital cost of the installation, it has to be remembered that the cost of so uncertain a method as putting down straw to cover a pitch is several hundred pounds (£300 to £400 was quoted at the demonstration). The cost has to be offset mainly against savings of "gates" otherwise lost through cancelled games; but there are incidental advantages of considerable significance. Playing conditions are kept consistently better in the usual winter, and there is some improvement in growth of grass. The soil-warming technique is particularly effective in preventing the particularly unpleasant condition of a thaw on the top of the ground with the subsoil still frozen.

Greyhound Tracks

Apart from football pitches, greyhound tracks offer a promising customer for this form of frost protection, and at least one installation has been completed in Scotland. Managements interested in this form of entertainment were amongst those represented at last week's demonstration.

The suggestion was made at the demonstration that any organisation thinking of using this form of anti-frost protection should consult with their local area board at an early stage, since it might be necessary to reinforce the local distribution system to cater for a load of the magnitude that would be involved.

Commutation at high speed

LOW INERTIA BRUSH IMPROVES D.C. COMMUTATION

TWO papers presented at a recent IEE meeting had little in common except that they were both concerned with rotating machines. The first dealt with investigations into bad commutation on high speed d.c. aircraft generators,* and the second described a method of determining the inductance of large a.c. machines†, and based on the Maxwell-Rayleigh bridge.

Observation of Commutation

The paper presented last week describes a new method of observing current changes in a coil undergoing commutation and gives results of tests using special low inertia brush to determine the effects of brush bounce.

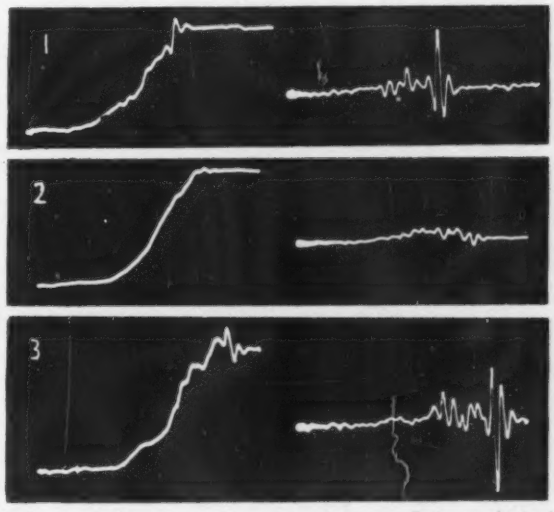
In the examination of current changes in a coil during commutation, earlier workers have used a voltage signal proportional to current in a particular armature coil obtained either by connecting a shunt temporarily in the coil under test, or, where the construction of the machine permitted, using the armature conductor itself as a shunt. Two serious limitations are imposed by such an arrangement: the resistance of the shunt must not be sufficient to disturb the current distribution in the armature, consequently the amplitude of the voltage signal obtained is restricted, and also great care must be taken to keep the e.m.f. picked-up by the loop, formed by the shunt leads and shunt, small compared with the resistive voltage drop across the shunt.

The authors' method is to obtain a signal proportional to rate-of-change of current and of an amplitude sufficiently large to overcome these difficulties. This signal is integrated by a simple resistance-capacitance network and displayed as current waveform on a c.r.o.

The current rate-of-change signal is obtained from a search coil encircling one of the end windings of the machine. Leads from the search coil are taken through the machine's hollow shaft to a pair of stainless steel slip-rings temporarily mounted at the commutator end of the armature. Silver graphite brushes are used.

A simple test gives the amplitude of the stray e.m.f. One of the armature conductors has to be temporarily broken so that the search coil can be placed in position. Before it is reconnected with the search coil encircling it, the machine is run and the stray e.m.f. at the brushes measured. On the machine tested, the stray e.m.f. signal was only approximately 1/1000th of the current change signal obtained, but of the same order as the signal which would have been produced by a shunt in the armature loop.

An ingenious yet simple triggering circuit for the oscilloscope enables a single trace or a succession of traces to be recorded. By recording armature current traces for successive positions of the armature relative to the field system, the manner in which the current changes as the commutator segments pass under the brushes can be investigated. A three-phase permanent magnet generator is temporarily coupled to the alternator shaft and its output used to energise the stator winding of a synchro. The output from the single-phase rotor winding of the synchro is filtered, squared and differentiated to give a series of pulses for triggering the oscilloscope time base. Rotating the synchro by hand triggers the oscilloscope at different positions of the armature test coil relative to the brush system. By rotating the synchro at a definite speed relative to the machine undergoing tests a succession of traces is obtained corresponding to consecutive positions of the armature.



Oscil ograms of armature coil current and its rate of change obtained with standard brushgear and a load of 100 A 108 V at 5,000 r.p.m.
Fig. 1. Interpole adjustment with 28.5 A buck
Fig. 2. Adjustment for best average commutation
Fig. 3. Interpole with 24 A boost

On the aircraft generator tested commutation was good at 5,000 r.p.m. but deteriorated rapidly as speed was raised to 10,000 r.p.m., this being indicated by steps on the waveform traces, as shown in Fig. 4. A previous writer has shown that these steps or discontinuities in the slope of the current waveform are caused by the brushes jumping over parts of the commutator at high speed. The paper confirms this finding and by constructing a low inertia experimental brush the authors were able to produce a reasonably smooth current trace.

Oscillograms obtained with the experimental search coils and integrating circuit are illustrated in Figs. 1 to 3. They show the effect of varying interpole excitation on the machine tested when the loading was 108 V, 100 A

* Paper M.2955: "A new method for observing the phenomena of commutation." By H. J. H. Sketch, B.SC.(ENG), A.M.I.E.E.; P. A. Shaw, B.SC.(ENG.), and R. J. K. Splatt, all of the Royal Aircraft Establishment.

† Paper M2871: "A method of measuring self-inductances applicable to large electrical machines." By Prof J. C. Prescott, D.ENG., and A. K. El-Kharashi, B.SC., both of King's College, University of Durham.

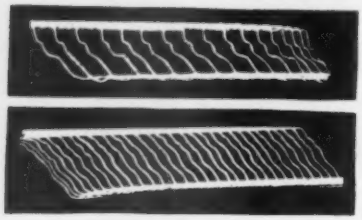


Fig. 4. Comparative c.r.o. traces obtained under the same load. Top trace shows severe sparking, despite best compensation, with standard brush gear. The lower trace was taken with the special low inertia brushgear. There was no sparking

at 5,000 r.p.m. The improved commutation obtained with test brushes when compared with standard brushes is clear from a comparison of the traces shown in Fig. 4. Both oscillograms shown were taken with the machine running at 10,000 r.p.m. and loaded to 200 A at 112 V.

Each brush consisted of a thin wafer cut from a standard brush and hinged from the brush-holder by a strip of phosphor bronze foil. Brush pressure was obtained by an 80 lb/sq in. air jet blowing into a small cup soldered to the back of the brush. The arrangement reduced brush inertia by about nine-tenths.

The authors show in the paper that the mechanism of current change in a coil undergoing commutation can be examined simply and without serious errors being introduced by stray e.m.f's, or dis'ortion of the current distribution in the armature conductors. Although developed with aircraft electrical systems in view, the method will probably be applicable to d.c. machines in general.

Inductances of Large Machines

Introducing the paper describing the use of a modified Maxwell-Rayleigh bridge for measuring large machine inductances, Professor J. C. Prescott commented that since publication it had been found that a number of the points had been anticipated in an earlier paper.

Several factors have to be allowed for in measuring self-inductance on a large machine. For example, an attempt to measure the self-inductance of a solid pole field by using a.c. is hampered by variations of inductance with frequency. If the measurement is attempted with a fluxmeter and search coil the further difficulty arises that, although the number of field turns may be known, it is necessary to know the effective number of turns before the self-inductance can be evaluated.

The basic bridge circuit is as shown in Fig. 5, but with the circuit K omitted. The coil whose self-inductance is to be found is connected at A. A Grassot fluxmeter is shunted across the two low value resistors R_c and R_c'. The required current is obtained with switch S closed by adjusting R. Currents in the two arms of the bridge are equalised by adjusting R_b. When the currents are equal, no creep will be apparent on the fluxmeter F. The self-inductance is obtained from the ratio of the change in flux linkages to the current change in the coil when the switch S is opened. The fluxmeter responds to e.m.f. generated inductively in A when the switch is opened by integrating rate-of-change of flux with respect to time, so giving the change in flux linkages.

The method is claimed to be useful for determining coil inductances of large machines. Where the currents are large, resistors R_c can be two shunts.

The method can be extended to measure apparent self-inductance as a function of time by arranging for the fluxmeter to be brought into circuit by a relay at a particular instant during the current decay cycle. This method was used by the authors to measure the transient and sub-transient reactance of a 10 kVA alternator and gave results comparable with those obtained by measurements made with an applied a.c. voltage.

The authors found the open-circuit and zero power factor characteristics of the synchronous machine by connecting appropriate armature phases at position A. The field winding was connected as shown in the circuit K and arranged to give an armature demagnetising effect.

The open-circuit characteristic was obtained with battery B removed by opening the switches S1 S2, and measuring the corresponding armature flux linkages. To obtain the zero-power-factor characteristic, the armature current was held constant, and the field current varied. Both field and armature currents were interrupted by the switches S1 S2 during this test.

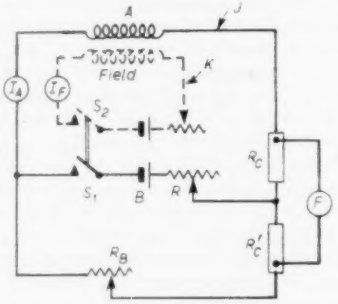


Fig. 5. Bridge circuit for measuring coil self-inductance. Open-circuit and zero-power-factor characteristics are obtained by connecting phase windings at A, and the field circuit as shown at K

DISCUSSION

PROF A. TUSTIN (Imperial College) presided at the meeting and opened the discussion. Complimenting the authors on their papers, he said it seemed that emphasis on electrical rather than mechanical aspects of commutation during the last 50 years may have been misplaced. It appeared that an investigation of brush bounce and commutator skin effects would be of value. He queried the setting shown for best commutation in Fig. 4 top, which has negative current loops.

MR D. EDMUNDSON (AEI Ltd.), asked if the authors considered the c.r.o. traces of current change a more sensitive test than visual setting for minimum sparking. He also asked why there was no obvious slope on the current rate-of-change trace, Figs. 1 to 3, corresponding to conductor current increase. Commenting on the second paper, he remarked on close agreement obtained by the authors on static and rotating test, but added that reactance was usually found as a by-product of other tests, which were at present essential.

MR J. REA (Rotax) said his firm had confirmed the authors findings on brush bounce troubles by deliberately introducing low bars on a commutator. In comparing modifications to machine brushgear he preferred to use the c.r.o. trace in conjunction with observation of sparking.

MR D. J. E. EVANS (Kennedy and Donkin) and MR H. WARD referred to industrial interest in improving commutation techniques. Had the authors considered extending their investigations to include internal e.m.f.'s, and were figures available on brush wear with standard and low inertia brushes?

Other contributors to the discussion were PROF G. RAWCLIFFE, MR D. H. THOMAS, MR H. WEST and MR S. RUDZINSKI (CERL), who referred to a method of determining self-inductances using a two-phase Schrage machine.

MR H. J. H. SKETCH, in reply said that although they had no information on relative brush wear, they had found that bedding of the experimental brushes took 80 hours compared with 10 hours for standard brushes, and this suggested that wear rate might be considerably less for the low inertia brush. He thought the c.r.o. trace gave a more sensitive estimate of best commutation conditions than observation. He explained that in Figs. 1 to 3 slope of the current rate-of-change trace is masked by the low gain used to obtain a complete trace of the spikes. Fig. 4 shows the best average commutation for the six-brush machine tested.

NOTES ON WIRING

BY MEGOHM

LIKE many other people I wondered what 1960 would bring and among my silent hopes and wishes as midnight struck on the 31st was one connected with these notes. I hoped that the New Year would bring a better understanding of our industry by architects and planners so that the many pieces of electrical apparatus now on the market could find sockets in the homes to operate from. A few days later my hopes were utterly and completely dashed when a representative of an accessories firm called to see me.

My friend had taken it on himself to assist in finding a new house for a relative and during his search had gone into the south east London area. There he found houses being built for around the £2,500 mark approximately and obtained details. An estate of 37 houses was being built, the houses having the normal two or three bedrooms, living room, bathroom and kitchen, although designed on the currently popular open plan. The documents were well prepared, but in the specification lay the shock I have mentioned.

"Bare Bones" Specification

The electrical "specification" comprised merely two clauses containing no more than 75 words. No mention of the IEE rules, no mention of earthing; I quote: "Provide 13 amp flush plastic socket-outlets and plugs to lounge and landing and 30 amp point in kitchen to electric cooker position, terminated by a 13 amp socket." I understand from my friend that this means one socket-outlet in the lounge (which is approximately 15 ft square) and one on the landing to serve two or three bedrooms. The kitchen-dining area served by its one socket is 14½ ft by 7½ ft. To cap it all, a paltry eight lighting points are specified. I doubt if there is a contractor in the whole of Great Britain who could not drive a coach and horses through that specification.

To add insult to injury, printed on the back of the brochure was a list of variations and extras. "Extra 13 amp ring main points, provided to lounge, kitchen and landing—£4 each." For £3 per time an extra lighting point would be provided in the ceiling and for £3 15s you can have a bracket point. So there it is again, the unwary purchaser is faced with a heavy bill even to obtain an adequate installation. Even more outrageous is the bold statement about these extras: ". . . the standard house is complete in itself and there is no need for extra fitments. . . ."

I.E.E. Ideas on Adequacy

Following hard on the heels of my friend's experience comes the IEE's statement on outlet adequacy, reported in last week's ELECTRICAL TIMES. One result of the IEE recommendation would be that for such a house as I have mentioned above a minimum of 20 socket-outlets is considered necessary. What a difference! But will these various examples of "how to do it" and "how not to do it" have any effect? I doubt it very much.

The IEE's study of the lighting aspect of adequacy brings out an interesting point. The investigating panel calls for more floor and wall space in kitchens to ensure suitable places for the various pieces of apparatus now used in that important room. Also mentioned was new apparatus which was coming within reach of the ordinary householder. I feel myself that before these ideas are adopted by the planners, they will be out of date and I suggest that somehow or other the whole matter must be given even wider publicity, for it is only the prospective buyer of a house who can force the issue.

Modern trends in home heating are also mentioned and this, of course, spotlights floor-heating. Here again I feel that we are still a little in the dark about it all. Many arguments go on regarding the type of system which should be used and, quite frankly, I prefer to sit and listen to the experts—with my feet stretched out towards a cheerful coal fire.

Cooker Circuits

Also in last week's issue there appeared in "Readers' Views" a letter on the matter of cooker circuits, following my comments of the previous week. I should like to thank the gentleman concerned; when I discussed the matter with several engineers they tried to convince me that it was "only at Christmas that the cooker was fully used." I refused to be convinced and, although my own cooker is only 7 kW loading, it is *very* often in full use. I hope that the know-alls do not write in and tell me that I am wasting electricity, because I am not.

The whole question revolves round the fact that certain cookers are of 11 to 12 kW loading and, therefore, the circuit, with its cables, controls and fuses, should be capable of accepting that full load without any detrimental effect to the circuit. There is not, in my opinion, any further argument required. It is now up to the BSI to rouse themselves and produce a standard for cooker control units above 30 amps. I know that the manufacturers would be only too pleased to help and with the backing of the ECA the danger could be cleared up. I use the word "danger" rather than "matter" because that is what I think it is.

New Switches

I have recently had sent to me samples of a new range of switches from a firm which I have never mentioned in these columns before. I was pleased to make their acquaintance again for I used their accessories many years ago when I had to handle screwdrivers and pliers.

These switches are of the now familiar pattern: small units held on to plates. The screws which hold the plate on to the box are deeply recessed and cannot be touched with the British Standard test finger. All live parts are mounted on non-track material and the joints between current-carrying parts do not rely on dimensional stability of mouldings. The action prevents the switch being held in a position which could cause continuous arcing.

Carrying prices which are extremely competitive, these switches should help those firms engaged in the housing drive. They are available in 1, 2 and 3 gang versions in brown or cream. When mounted in plaster depth boxes they give $\frac{3}{8}$ in. minimum clearance for wiring.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Columbia Report

With the recent signing of the report of the International Joint Commission setting out the principles to be followed in future joint development of the Columbia River, Canada and the USA are expected to negotiate a treaty within the next few months. The Canadian Prime Minister, Mr Diefenbaker, stated last week that the negotiations are to start quickly. The Commission has recommended that downstream power benefits are to be shared equally by Canada and the US (as we intimated on 17 Dec.), with the US compensating Canada for the flood control benefits created by Canadian storage.

Generators for Squaw Rapids

English Electric Co. Ltd. have obtained the order for six 37,500 kVA generators for the Squaw Rapids hydro-electric development of the Saskatchewan Power Corporation. The first set will be commissioned late in 1962, and the whole project is to be completed by November, 1964. We reported on 17 Dec. that the order for the associated six hydraulic turbines had been placed with A. Johnson and Co. (Canada) Ltd. These are to be manufactured at the plant of Sorel Industries Ltd. at Sorel, Quebec. The Squaw Rapids project will be the first hydro-electric installation on the system of the Power Corporation. Total cost, including construction of the dam on the Saskatchewan River and other related works, has been estimated at about $46½ million.

Manufacturer's Outlook

Capital expenditure in Canada during 1960 is expected to show the first year-to-year increase since 1957, according to Mr J. Herbert Smith, president of the Canadian General Electric Co. The emphasis is likely to be on new machinery and equipment rather than on new construction. The recent decline in capital spending, said Mr Smith, weighed heavily on the electrical industry, because of a reduction in equipment ordered for utilities and heavy industry. Preliminary estimates indicate that electrical products shipped by Canadian manufacturers in 1959 will total $1,100 million, a decline of 2% from the 1958 figure. This is a continuation of a trend that has been apparent for the past four years. In 1956, the peak year, shipments were valued at $1,229·9 million. Much of Canada's electrical manufacturing industry is oriented towards production of heavy capital goods, although there is keen competition in that sphere from overseas firms. The industry generally has attempted to meet European prices in the apparatus field. As an example, said Mr Smith, the price of power transformers has been reduced by 12% since 1949, despite a 52% increase in the cost of labour and materials. In the consumer field, it is almost inevitable that product prices will rise in 1960. The cumulative effect of high interest rates, a rising cost of living index and other inflationary factors is exerting an upward pressure on costs, and the cost increase cannot be absorbed by manufacturers.

U.S.A.

Cleaner Hands?

Collaborators be warned! For exchanging information concerning prices and other matters with representatives of competing companies, certain officials of the General Electric of America have been severely disciplined by the company. Some have been removed to less responsible positions and had their salaries cut, according to Mr R. Cordiner, the chairman, who has explained that the matter was dealt with stringently because it was the company's policy to comply carefully with the US Anti-Trust laws. In fact this action results from the investigation carried out by a Grand Jury in Philadelphia into the pricing policies of various electrical manufacturers who submitted tenders for plant to Government agencies. It was revealed that in some instances identical tenders had been submitted by American firms.

POLAND

Mobile Substations

Four mobile h.v. traction substations, each with equipment mounted on three trucks and capable of an output of 4,400 kW d.c., have been supplied to the Polish Railways by ACEC, of Belgium. In each unit, two trucks carry the two transformer-rectifier circuits with their control gear, and the third the line breakers, control panel, line testing equipment and harmonic filters. They are designed to operate without supervision and can be remotely controlled if required. They are fed from 30 kV a.c. power lines and feed 3·3 kV d.c. to the railway network.

GREECE

Aid for h.e. Scheme

The Development Loan Fund in Washington has approved in principle a $31 million loan to Greece for the construction of the Acheloos hydro-electric scheme. We reported on 19 Nov. that an American firm of consulting engineers had completed a technical survey of the proposed scheme, and the Greek Government were seeking financial aid from the Loan Fund.

EGYPT

Power from Nile

The first main hydraulic turbo-generator and some auxiliary plant at the existing Aswan Dam power station was formally switched on last week-end by President Nasser. This station was originally designed by British consulting engineers and stands some four miles from the site of the projected Aswan High dam. First power from the new station went to the nearby fertiliser plant which President Nasser also switched on. He then officially inaugurated site work on the new Aswan High dam. A decision on who is to undertake the second stage of the latter (including the power plant) is expected to be made later this year.

SUDAN

H.E. Work Inaugurated

Work on the Sennar hydro-electric project was officially inaugurated a few days ago. The ceremony was performed jointly by President General Abboud of the Republic of the Sudan, and Haile Selassie, Emperor of Ethiopa. As we earlier reported, the job has been entrusted to a consortium of the English Electric Co. Ltd. and Siemens-Schuckertwerke. It includes the building of a hydro-electric station with two English Electric 7,500 kW Kaplan water turbine sets at the existing dam at Sennar, on the Blue Nile; the extension of the Burri power station in Khartoum by the installation of a new 10 MW English Electric steam generating set, and the erection of an overhead transmission line to connect Sennar with Khartoum, with intermediate substations at Wad Medani and Hassa Heissa.

AFRICA

Link in Kenya

A £450,000 line scheme inaugurated by the East African Power and Lighting Co. to link four centres in Kenya's Nyanza Province, is nearing completion. A supply to Kericho was first given last October, and the scheme provided for subsequent connection of Koru, Miwani and Kisumu. Supply is being given to several industries along the route, including a large sugar factory at Miwani, tea factories in the Nandi area and industries at Kisumu which now rely entirely on the small local power station. At the first switching-on ceremony, at Kericho, Mr W. E. Rolls, of the East African Power and Lighting Co. emphasised that the supply had only been made possible by the construction of the 132 kV line of the Kenya Power Co. from Tororo to Nairobi. The new 33 kV line from Lessos passes through one of the worst lightning areas known.

INDIA

Electrical Factory

The Government of India have decided to speed up the second and third phases of construction in the heavy electricals factory at Bhopal, the public sector undertaking. According to the third annual report of this project, the authorities have been asked to draw up revised estimates for facilitating an annual output of Rs250 million (£118·75 million). Towards the end of 1957-58, due to foreign exchange difficulties, the Government decided to phase the company's manufacturing programmes in three stages—only the first phase was to be taken up immediately. It was in March, 1957, that the Government accepted the proposals of Associated Electrical Industries Ltd. for the establishment of the factory. It was then estimated that the total cost would be some £35 million, and take about 12 years to complete. As consultants, AEI will receive a total of £400,000 paid in instalments at various stages of the scheme, according to the progress made. The first stage, which was scheduled to be in operation by 1961, provided for the manufacture of rotating machinery, rectifiers, transformers, switchgear, industrial control gear, and water turbines and associated equipment.

TURKEY'S HIRFANLI H.E. PROJECT

Three 44,000 h.p. generators are now in operation at the Hirfanli hydro-electric project, which was officially inaugurated by Turkey's Prime Minister, Mr A. Menderes, last Friday. The scheme, to utilise Turkey's longest river, the Kisilirmak, is part of a larger plant to supply 60% of the country's electricity needs from water power. It was designed by American consulting engineers, Tippetts-Abbett-McCarthy-Stratton in consultation with the Turkish State Water Board, and has been jointly carried out by the English Electric Co. and George Wimpey and Co. Ltd. A dam, 85 metres high and 366 metres long, forms a new lake 46 miles long and nine miles across at its widest point, which will be used as a holiday resort by the people of Ankara, 90 miles away. English Electric were responsible for the design and construction of the electrical installations, while the dam and accompanying civil engineering work were built by Wimpey's. The three reaction water turbines operate on a maximum head of 217 ft. The power house has provision for the addition of a fourth machine if required. In the control room, the layout of the instruments and operating gear enables the entire scheme to be operated by one man. On the right is the turbine hall showing the three machines. Below is a panoramic view of the power scheme, with the dam and lake to the right

Personalities *in the industry*

Mr J. Parkin

Mr H. W. Thompson

Mr G. A. Williams

Mr B. A. Winship

Mr G. H. Beales

More new appointments are announced by AEI-Hotpoint Ltd. **Mr J. Parkin,** B.A., who has been marketing manager, refrigerators, since Dec., 1957, becomes sales promotion manager. He joined the company in Aug., 1956, as assistant marketing manager, home laundry. He is a member of the Domestic Refrigeration Development Committee and of the British Refrigeration Association. He is succeeded as refrigeration marketing manager by **Mr H. W. Thompson** who has been marketing manager, home laundry, since last Aug. Mr Thompson joined Hotpoint in June, 1957, as manager, South Eastern District. **Mr G. A. Williams,** ASSOCIATE I.E.E., A.S.M.A., becomes technical services manager. He served a special apprenticeship with BTH, Rugby, and later held various positions on motor design in the engineering laboratory and finally as home laundry appliance design engineer. Transferring to AEI-Hotpoint at Peterborough, he became commercial manager in July, 1953, and technical sales promotion manager at head office in Aug. 1956. **Mr B. A. Winship,** M.A., who joined the company in Dec., 1956, as marketing assistant, small appliances, and became assistant marketing manager, home laundry group, in July, 1958, has been appointed product planning manager. Finally, **Mr G. H. Beales** becomes service division manager. He joined the company in Oct., 1956, as sales office manager, and since July, 1957, has been manager, sales administration.

Head of the Department of Electrical Engineering at Wigan and District Mining and Technical College for the past six years, **Mr E. T. Blakeman,** B.SC.(ENG.), A.M.I.E.E., has accepted an appointment as principal lecturer in mechanical engineering at the Bolton Technical Teachers' Training College. He takes up his new post next May. Mr Blakeman has been at the Wigan Technical College since 1948, going there as an assistant lecturer, after four years with the English Electric Co.'s Preston Works as project draughtsman on the development of new aircraft. He served his apprenticeship at that company's Stafford works and subsequently, for three years, was a draughtsman in the electrical machine section.

Formerly sales manager of Patterson Lamps (1953) Ltd. **Mr T. H. Clarke** has been appointed general manager of the company.

Mr D. W. Heightman has been appointed to the board of Radio Rentals as technical director. He joined the company in 1956 as chief engineer of the group.

Formerly Fens sub-area commercial officer to the Eastern Electricity Board, **Mr R. B. Richardson,** D.P.A., A.M.I.E.E., has now taken up a similar position with the board's Chilterns sub-area, in place of **Mr R. T. Hows,** D.F.H., A.M.I.E.E., who has relinquished the position for family health reasons (*ESH, page 100). Before joining the Eastern Board in 1952, Mr Richardson was commercial officer with No. 6 (Hull) sub-area of the Yorkshire Electricity Board.

Mr J. F. Coales, O.B.E., M.A., M.I.E.E., F.INST.P., Reader in Control Engineering, Cambridge University, has been elected chairman of the reconstituted executive committee of the British Group for Computation and Automatic Control.

The Eastern Region, British Railways, announce the appointment of **Mr J. Stacey,** formerly acting assistant stores superintendent, Eastern and North Eastern Regions, as supplies officer in the department of the supplies and contracts manager, Eastern Region. This is a newly created position arising from the termination of the bi-regional control of the Stores Department and the setting up of separate supplies organisations in the Eastern and North Eastern Regions, each under the control of a supplies and contracts manager. Mr Stacey entered the service of the Great Northern Railway in the Stores Department, Doncaster, in 1918 and continued in the Divisional Stores Superintendent's Office until appointed storekeeper of the General Stores Depot, LNER, Marylebone, in 1933. In 1940, he became storekeeper, Engineer's Sundry Stores, King's Cross, from where he was transferred in 1942 as storekeeper at the Carriage and Wagon Works, Holgate, York, and came under the control of the chief mechanical and electrical engineer in April, 1943. Soon after the return of the depot to the control of the stores superintendent in 1948, Mr Stacey was promoted assistant (control) at King's Cross in 1949. He became assistant (purchases) in May, 1950, assistant (planning) in 1951 and assistant (storekeeping) in 1952, since when he has been actively engaged in connection with the reorganisation and modernisation of the depots on the Eastern and North Eastern Regions. He was appointed general assistant to the stores superintendent in November, 1956, and has been acting assistant store superintendent since December, 1958.

Dr Robert C. Langford, B.SC.(ENG.), A.M.I.E.E., M.AM.I.E.E., has been appointed director of engineering of the Newark (N.J.) operations of Weston Instruments Division of Daystrom Inc., of USA. He succeeds **Mr F. X. Lamb,** FEL.AM.I.E.E., who becomes engineering consultant. Dr Langford was born in Portsmouth and studied at the University of London and Queen Mary College. He went to America in 1952 and transferred to Weston as a senior engineer following eight years' experience with its affiliate concern in England.

Mr W. E. Spurling, for the past nine years general manager of the Bermuda Electric Light Co. has retired. He is succeeded by **Mr Llewellyn Vorley.** Mr Spurling has been 48 years with the company. He will continue to act as secretary-adviser to the board of directors of which he is a member.

Mr D. F. Pierce, A.M.I.E.E., DIP.M.I.E.S., has been appointed controller, material purchases, with Simms Motor Units Ltd. He has been associated with that

group for a considerable number of years, serving in various departments.

President Nasser has just awarded United Arab Republic decorations to three British engineers for their part in the construction of the Aswan hydro-electric station which he officially opened last week-end. **Mr G. F. Kennedy,** M.A., M.I.MECH.E., M.I.E.E., M.INST.C.E., partner, Kennedy and Donkin, receives the Grand Cordon of Merit; **Mr R. B. Croft,** also of Kennedy and Donkin, is awarded the Commander Order of Merit; and **Mr C. A. Stephens** the Commander Order of the Republic.

The appointment of **Mr Edwin E. Hewett** as sales engineer is announced by Nash and Thompson Ltd. Mr Hewett, who is a member of SONDE, was previously a specialist in ultrasonic flow detection techniques with Cossor's.

Mr W. P. Rowley has been appointed assistant managing director of W. S. Electronics Ltd.

William McGeoch and Co. Ltd. announce new appointments in their sales organisation, which now also covers their associate companies, Veritys (Maxlume) Ltd. and Veritys (Switchgear) Ltd. **Mr P. G. Payne,** M.A.S.E.E., formerly senior sales engineer, becomes sales manager. The area sales engineers are: London (West), **Mr D. J. Cubbage** (formerly of Crompton Parkinson (Fosters); London (South), **Mr R. M. Page** (previously with Crompton Parkinson); Midlands (north), **Mr L. D. Fitzmaurice** (late of Veritys Ltd.); Midlands (South), **Mr H. C. B. Woodcock,** B.E.M. (formerly with Philips Electrical Ltd.); North West (Lighting Division), **Mr A. Moorefield** (late of Veritys Ltd. and Popes Electric Lamps Co.); and North East, **Mr J. Hornby** (previously with Carron Co.).

Secretary of the Swansea and West Central area of the South Wales Electricity Board since 1948. **Mr C. R. Nicholson** has retired after nearly 38 years' service in the industry. His successor is **Mr D. G. Jones** who has been principal assistant (personnel) at the board's headquarters since May, 1957. (*ESH, page 124.) Mr Nicholson joined the staff of the former Electricity Department of the Swansea Corporation in March, 1922, and after serving in various administrative capacities became chief commercial assistant to the engineer and manager of the department in April, 1942, and held this appointment until the industry was nationalised in 1948. Mr D. G. Jones also entered the industry with the Swansea Corporation undertaking. From 1948 he served in various administrative capacities with the South Wales Board until 1951 when he was appointed principal assistant (personnel) with the Eastern Electricity Board at Ipswich. He returned to a similar post with the South Wales Board in 1957.

Purchasing manager of Watford Electric and Manufacturing Co., **Mr J. J. Brook** retired recently after 46 years' service with the firm. To mark the occasion he was presented with a TV set and a cheque by the chairman, **Mr J. L. Lawson.**

Mr W. H. Longley has been appointed director and chief accountant of Simms Motor Units Ltd., whom he joined in 1946.

** Denotes revision to the "Electricity Supply Handbook, 1959."*

More A.E.I. Appointments

Dr J. N. Aldington

Mr W. G. Patterson

Mr C. C. McCallum

Appointments with the newly formed Associated Electrical Industries (Woolwich) Ltd., which is managing the four new product divisions for Telecommunications, Radio and Electronic Components, Cables, and Construction (cables and lines), have now been announced. The board of directors consists of:

Chairman: **Lord Chandos.**
Group Managing Director: **Dr J. N. Aldington.**
Director of Research: **Dr T. E. Allibone.**
Director of Engineering (telecommunications): **Mr L. S. Crutch.**
Directors of Manufacture: **Mr G. W. Giffin** and **Mr J. T. Thornhill.**
Export Director: **Mr B. A. Hensler.**
Commercial Director: **Mr J. W. Ridgeway.**
Director of Engineering (radio): **Mr A. Whitaker.**
Director of Engineering (cable): **Mr S. E. Goodall.**
Other directors: **Mr R. L. Basset** and **Mr A. F. Street.**
Secretary of the company: **Mr S. W. Lumb.**

The board is therefore virtually that of Siemens Edison Swan Ltd., apart from the resignation of Sir Alexander Sim and the appointment of Mr S. E. Goodall who has been associated with W. T. Henley's Telegraph Works Co. since 1944, from 1946 as chief engineer.

Executive structure of the four new AEI Product Divisions is as follows:

AEI Telecommunications Div.
General Manager: **Mr W. G. Patterson.**
Manufacturing Manager: **Mr J. M. Wilcox.**
Chief Engineer: **Mr F. G. Pheazey.**
Engineering Manager: **Mr T. J. Scudder.**
Commercial Manager: **Mr D. J. Green.**

AEI Radio and Electronic Components Div.
General Manager: **Mr C. C. McCallum.**
Manufacturing Manager: **Mr A. G. Everett.**
Engineering Manager (development): **Mr J. Donegan.**
Engineering Manager (consultative): **Mr C. L. Hirsham.**
Sales Manager: **Mr P. V. Lister.**

AEI Cable Division
Jt. Div. General Managers: **Mr J. S. A. Bunting** and **Mr E. J. Vidler.**
Manufacturing Managers: **Mr V. L. J. Plascott** and **Mr S. J. Wilson.**
Chief Engineers: **Mr W. G. Hawley** and **Mr J. H. Savage.**
Sales Manager: **Mr H. D. Parsons.**
Commercial Manager: **Mr F. V. Vaissiere.**

AEI Construction (Cables and Lines) Div.
General Manager: **Mr A. V. Burnett.**
Chief Engineer: **Mr W. Sim.**
Commercial Manager: **Mr L. F. Capeling.**

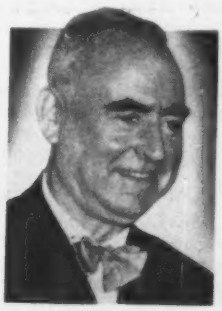
AEI Motor and Control Gear Division

The following managerial appointments have been made:

Assistant Div. Manufacturing Manager: **Mr E. G. Crossling.**
Consultant and Manager, Industrial Applications Engineering Dept.: **Mr B. Pringle,** M.B.E.
Manager, Small Industrial Machines Engineering Dept.: **Mr D. G. Smith,** B.SC.(ENG.), A.M.I.E.E.
Superintendent, Control Gear and Ardoloy factories: **Mr J. H. Cribb,** A.M.I.PROD.E.
Manager, F.H.P. Machines Engineering Dept. (Newcastle, Staffs): **Mr F. L. Fletcher,** B.SC.(ENG.), M.I.E.E.
Manager, Large Industrial Machines Engineering Dept. (Manchester): **Mr J. Titterington,** M.I.E.E.

Mr J. S. A. Bunting

Mr E. J. Vidler



Mr A. V. Burnett

Mr H. Hewitt

Mr H. C. Weston

Mr A. E. Gregg

Atlas Lighting Ltd. announce the reorganisation of their research and development facilities, involving the formation of a Lighting Development Group under the control of **Mr H. Hewitt,** A.M.I.E.E., F.I.E.S., at present assistant technical sales manager at the Atlas head office in Thorn House. The group will be based on the Atlas Lighting Laboratories at Enfield, under Dr J. W. Strange, and will be concerned with the application of light sources and the development of lighting techniques. Mr Hewitt is well known as a lecturer on lighting matters and is the author of *Modern Lighting Technique* and a number of papers. He has also acted as honorary editor of the *Transactions of the IES* for the last three years. The company has also retained **Mr H. C. Weston,** O.B.E., F.I.E.S., as consultant on light and vision. Mr Weston, whose name is always associated with the IES Lighting Code, recently retired from the staff of the Medical Research Council. He is a past-president of the IES and has made a special study of lighting requirements for workers and is a world authority on lighting and visual performance. He is the author of *Sight, Light and Efficiency*. Mr Weston is the British member of the International Illumination Committee of experts on lighting and visual performance and was leader of the British delegation of the 1959 meeting of the Commission in Brussels.

The Eastern Electricity Board have promoted **Mr D. A. Rayner,** F.A.C.C.A., to deputy chief accountant, a position formerly occupied by **Mr F. S. Grindrod** who is now the chief accountant (*ESH, page 99). Mr Rayner, who is 51, joined the board in 1948 and has been an assistant chief accountant since that date. Previously he held various accountancy posts with the Northmet Power Co. and was a senior accountant at the time of nationalisation. Since 1954 Mr Rayner has also carried out the duties of organisation and methods officer. He will continue to be responsible for the development of this work and its co-ordination throughout the organisation.

Mr H. R. Johnson has been appointed manager of AEI-Hotpoint's Newcastle upon Tyne district office in succession to **Mr P. C. N. Browne** who retired at the end of December last. Since November, 1958, Mr Johnson has been Northern Division assistant at the London headquarters. Earlier, he was with the sales force, covering the Merseyside and North Wales area. Mr Browne's colleagues presented him with an engraved silver cigarette case on his retirement. He had been branch manager at Newcastle for 25 years.

General sales manager of AEI-Hotpoint Ltd. since 1 July last, **Mr J. D. Lake** has been appointed sales director as from 5 Jan.

Mr A. E. Gregg, ASSOC.M.C.T., ASSOCIATE I.E.E., has been appointed a director and general manager of Crompton Parkinson (Chelmsford) Ltd. **Mr A. V. Sowman,** M.I.E.E., managing director, remains in that capacity. Mr Gregg has been with the Crompton Parkinson group since 1936 and for the past year has been general manager at the Group's Guiseley works. Prior to that he was product manager for motors at the Guiseley works and he was also general manager of the Overseas Works Division, in which capacity he travelled extensively in the Commonwealth and North America, visiting the group's manufacturing plants overseas. He has twice been a member of the Crompton Parkinson Ltd. Junior Board and was chairman on both occasions.

Mr S. H. Tombs, general manager of Globelite Industries Ltd. has been elected to the board of that company.

Sir Arthur Elton, BT., has been appointed controller of the Central Information Department of Associated Electrical Industries Ltd. as from 1 March. **Mr S. C. Leslie,** who was appointed a year ago as AEI's consultant on information policy, has been acting for the past six months as head of the Central Information Department during the process of its establishment. From 1 March he will be free to resume his consultancy duties.

OBITUARY

Mr Philip R. Coursey, B.SC.(ENG.), M.I.E.E., F.INST.P., F.PHY.S., M.R.I., formerly technical director of the Dubilier Condenser Co., died on 3 Jan., aged 68. The inventor of numerous patents, he was the originator of many important developments, and the author of several books on such subjects as electrolytic condensers, and wireless telephony. He joined Dubilier in 1923 after a period with a radio journal.

Mr H. A. Gearing, formerly substation superintendent with the Brighton Corporation undertaking until retiring in 1941, died on 24 Dec., aged 83. He served with the Corporation from 1892, apart from a period of six years as electrical engineer to the Palace Pier Co.

Mr W. B. Sanders, formerly senior commercial assistant at Teignmouth, to the South Western Electricity Board, died recently, aged 63.

Sir Reginald R. Whitty, a director of British Thermostat Co. and MEC Holdings Ltd. and other concerns, died on 6 Jan., aged 68.

Councillor H. H. Sutcliffe, who was electrical engineer and manager to the Hebden Bridge U.D.C. for many years until nationalisation of the industry, and then became chief executive officer there to the Yorkshire Electricity Board, died on 8 Jan., aged 71.

Mr Norman T. Smith, M.I.E.E., A.M.I.MECH.E., general manager of the Nova Scotia Light and Power Co. Ltd. for the past 11 years, died in Phoenix, Arizona, on 27 Dec., aged 59. Prior to going to Canada in 1949, Mr Smith was manager of No. 2 sub-area of the Merseyside and North Wales Electricity Board. Prior to nationalisation of the industry he was borough electrical engineer at Warrington for nine years, after three years in a similar post at South Shields. Mr Smith became the first county electrical engineer to the Kirkcudbright County Council in 1933.

Mr D. A. Rayner

Mr H. R. Johnson

Mr J. D. Lake

Cables in lamp fittings

C.M.A. WARNS AGAINST TEMPERATURE DANGERS

LIFE in service of conventional types of wiring cables and flexible cords when used in association with modern lamps and fittings is causing some concern due to the increasing temperatures being experienced. Against this background, the Cable Makers' Association have felt that a restatement of the temperature limitations which apply to the various types of cables which are now available can serve a useful purpose to all who are concerned with the design and installation of lighting systems.

It is useful to recall that some years ago the Electrical Research Association carried out some work on measurement of the temperatures encountered in lamp holders (ERA Report F/T138), and it was discovered that with the type of fittings then used for office and factory lighting, lamps of 100 watts could give temperature rises at the lamp holder terminals of about 80°C above ambient temperature. Temperature measurements carried out on the core insulation $\frac{1}{4}$ in. away from the lamp holder terminal showed that the temperature rise could be greater than 60°C. This meant that when a lighting fitting was used in an ambient air temperature of 25°C, the rubber insulation could be above 85°C.

More recently the physical sizes of many lamps have been reduced so that it is now possible, for example, for a 100 watt lamp to be fitted into an enclosed type of fitting which previously was designed to accommodate a maximum lamp size of 60 watts. This can give, and has in fact given, rise to much higher temperatures at the lamp holder terminals than those mentioned in the above ERA report. As an extreme case of what can happen there have been cases where certain types of lighting fittings on board ships have been incorrectly fitted with 100 watt bulbs where they were only intended to have 60 watt lamps. When the ships sailed through tropical waters where the cabin air temperature has been as high as 40°C, it was found that the temperature of the rubber insulation was as much as 160°C.

Temperature Limits

Reference to the Thirteenth Edition of the IEE Wiring Regulations shows that they contain the essence of desirable practice. In Regulation 211A, rubber, p.v.c.- and polythene-insulated cables or flexible cords are recommended for operating in ambient temperatures not exceeding 45°C, which means that if a cable is fully loaded to its maximum IEE current rating, the increase in temperature due to the passage of the current will not raise the temperature of the cable insulation to much more than the safe value of about 60°C.

Regulation 211B also stipulates that unless cables and flexible cords are of a special design which permits them to withstand high temperatures they shall not be brought into lighting fittings where, under normal working conditions, the conductor is likely to attain an excessive temperature owing to the transfer of heat.

As indicated by the extract from the IEE Wiring Regulations quoted above, there are accepted maximum temperatures for the three most common materials used today for the insulation of wiring cables and flexible cords. When the cables and cords are operated at temperatures in excess of the recognised limits this leads to progressively rapid deterioration and premature failure in service. A few comments on the available forms of insulation will be helpful.

Natural Rubber. Natural rubber insulation as used, for example, to insulate cables to BS 7, is only suitable for temperatures up to about 60°C, and under normal conditions a rubber-insulated cable can have a useful life of well over 20 years. However, at higher temperatures the rubber ages with increasing severity and with increase of temperature which can be encountered in lamp holders with, say, 100 watt lamps, the life of the rubber insulation can be reduced to a few years only. In addition, when natural rubber insulation is heated to temperatures above about 130°C there is a tendency for the rubber to become very soft in the early stages of its life, and this can result in the insulation flowing away from the conductor at points where the core is under any mechanical pressure so that a short-circuit can occur between a live conductor and the earthed metalwork of a fitting. Thus in the case of the ship lighting fittings mentioned earlier electrical failures have taken place frequently.

Polythene. Polythene insulation as employed, for example, in BS 1557 cables, can be safely used at temperatures up to 70°C. IEE Regulation 211B specifically mentions the danger of using polythene insulated cables at rather high temperatures, as this form of insulation has a sharp melting point of around 110°C.

Polyvinyl Chloride. Cables and flexible cords insulated with p.v.c., e.g., to BS 2004, can be safely used at temperatures up to 70°C. At temperatures above this there is a risk of the insulation flowing away from the conductor if the core is under any mechanical pressure. Various types of high-temperature-resistant p.v.c. compounds are now available, but even so they must be used with caution in view of the very high temperatures obtained in many lighting installations.

Polychloroprene. Polychloroprene (neoprene) has from time to time been suggested for the high temperature connections to lamps, but this synthetic rubber, although perhaps equal to natural rubber in its ageing properties in the region of 60°C or 70°C, is still unsuitable for the very high temperatures which are often encountered in fittings. It has been found that when polychloroprene insulation has been subjected to an elevated temperature for a time and then the insulation has been allowed to cool to normal room temperature, there has been a large absorption by the aged insulation of moisture from the atmosphere, with the result that the insulation quickly fails electrically.

Butyl rubber. Butyl-rubber-insulated cables are a fairly recent introduction and a new British Standard is being prepared to cover these types. This insulation has certain

high temperature advantages over those mentioned above, but, nevertheless, its maximum operating temperature, unless the core is protected by asbestos rovings, should not exceed 85°C. At this point, a warning should be sounded against using butyl rubber at very high temperatures such as are encountered in some lighting fittings. Although butyl rubber has superior heat resistance to natural rubber at moderately high temperatures, it has been discovered that at higher temperatures in the region of 130°C or 140°C butyl rubber insulation compound may very quickly age, and in the same way as natural rubber, it eventually becomes very hard. In addition it can finally turn into powder and easily drop off the wire if the insulation is disturbed in any way or subjected to vibration as, for example, on board a ship.

Varnished cambric/heat resisting fibre. Cables insulated with a composite covering of varnished cambric and heat resisting fibre are to be included in a new British Standard at present being formulated. This form of insulation may be operated at a maximum temperature of 85°C, but it should only be used in dry situations owing to its somewhat hygroscopic nature.

Butyl rubber/asbestos roving. Cables insulated with butyl rubber, over which is applied on each core a lapping of asbestos roving, are also included in a new British Standard now being prepared. These cables are suitable for operating at a maximum temperature of 100°C, which is slightly in excess of the maximum operating temperature for ordinary butyl-insulated cables mentioned above, but nevertheless, the insulation can still be liable to the same shortcomings as ordinary butyl rubber at high temperatures in the region of 160°C.

Silicone rubber. Cables and flexible cords insulated with silicone rubber can be safely operated continuously at temperatures up to and including 150°C and for intermittent periods up to 200°C. A new British Standard is being prepared to cover these types.

General Consideration

It is difficult for the cable maker to go much beyond drawing attention to the temperature limitations of the various cable insulation materials, since the design of lamps and fittings is beyond his control. It would seem apparent from the earlier ERA work and the known trends in the development of lamps and fittings that the stage has been reached where unless adequate precautions are taken, there is a serious risk of lighting installations being the cause of failure of the associated cable or flexible cord.

It cannot be too strongly stressed that it is most important that those who design and install lighting fittings should be aware of the limitations of rubber-like and thermoplastic insulations at high temperatures. Every effort should be made to design fittings such that the temperature likely to be attained at the terminals of the lamp holder is kept to a reasonable level having regard to the limiting temperatures quoted in the survey of insulating materials above.

If it is not possible so to limit the temperatures to which the cables are subjected, the fittings should be so arranged that heat resisting tails can be easily run from the lamp holder itself to a terminal block mounted in a cool accessible position where connection may be made to the standard wiring cable.

Suitable high temperature tails include wires insulated with silicone rubber, as described above, where the insulation may be further protected, if required, by a covering of glass fibre treated with silicone varnish, in which case the maximum operating temperature will be 150/200°C. For temperatures above 150/200°C the most practical type of insulated tail consists of bare wires upon which are threaded porcelain beads.

Existing Installations

With the present trend to reduce lamp bulb sizes resulting in higher operating temperatures, there is the increasing serious problem of maintaining existing wiring installations in a safe working condition.

In the case of pendant lighting fittings the replacement of the existing pendant flex between the lamp holder and the fixed wiring by one of the heat-resisting types of flex will largely overcome the trouble. However, where lighting fittings are directly connected to the building wiring, as, for example, with ceiling fittings, there is always danger of the cable insulation failing with the resultant fire risk and the provision of suitable new wiring to withstand the high temperatures could be a costly business. A temporary method of overcoming the difficulty is to fit over the cable ends high-temperature-resisting insulating sleeves made from materials such as silicone-varnished glass braiding. This may not always be a practical method, however, as the dimensions of many fittings do not allow the sleeving to be accommodated.

The above suggested replacement or treatment of existing cables to cater for the higher temperatures might be readily tackled by electrical engineers and electricians who appreciate the problems involved, but unfortunately there are the non-technical general public purchasers of large quantities of lamps who must also be considered.

If it is now possible to fit a 100 watt lamp into an enclosed fitting designed for a maximum lamp size of 60 watts the man in the street will not hesitate to use the larger wattage lamp if he wants more light. He does not appreciate the problem of the high temperatures involved and, therefore, he cannot be expected to realise that the wiring in and adjacent to the fittings may very quickly reach a dangerous condition.

The only real answer to the problem is the use of well-designed fittings together with lamps no higher in wattage than that for which the fittings are rated. This would ensure that the heat at the cable entry and connection points is not greater than that which the various components can withstand.

Palladium for Printed Circuits

COPPER is the usual conductor on printed circuit cards, but there are some applications in which it is not the best choice. An example is when the cards are designed for plugging into a specially designed socket, an arrangement widely used in computers. Here copper falls down as a contact material; it is relatively soft and oxidation may bring contact resistance troubles. In the January number of *Platinum Metals Review*, the claims of palladium for this application are advanced. This material has good hardness as electroplated on to a copper base track, is free from attack by the atmosphere, tolerably free from porosity, and relatively inexpensive. It is claimed that a deposit only 0·00005 in. thick will remain tarnish-free in store and give a short operating life. For improved working life, deposits up to 0·0002 in. thick are recommended. If it is desired to confine the palladium plating to certain areas of the copper track on the printed circuit, this can be done during plating by using a chlorinated rubber masking paint or masking tape.

Lisbon Underground Railway

BRITISH ELECTRICAL EQUIPMENT ON NEW SYSTEM

THE inhabitants of Lisbon, capital city of Portugal, have celebrated the New Year with a brand new underground system, the first stage of which was opened to them on 29 December. Lisbon, like so many capital cities these days, has been faced with an ever increasing traffic problem on its streets and, also like other cities, has for many years been considering the creation of an underground railway, on the lines of London's tubes, as one of the means of relieving its problems. In 1953 the authorities took the momentous decision to authorise the construction of a railway system and the Metropolitano de Lisboa S.A.R.L. was born. By 1955 the stage had been reached where contracts for the electrical equipment could be placed and the General Electric Co. was a successful tenderer, being awarded a contract valued at some £200,000 for the supply of power equipment comprising transformers, rectifiers, control panels and switchgear, stand-by generating plant, ventilating fans and cables. They were the only successful tenderers from Britain against fierce competition from continental manufacturers.

The first stage of the project is a 4·3 mile section between Restauradores to Entre Campos and a branch from Rotunda to Sete Rios, with a gauge of 4 ft 8½ in., the d.c. track voltage being 750 V. Ultimately the route mileage will be just under 12, with an envisaged extension to 25¾ miles. The completed and proposed routes are shown in Fig. 1.

Power is supplied from the National Grid system at 10 kV 3-phase 50 c.p.s. to a seven panel board at Rotunda substation through two feeders, Santa Marte Nos.1 and 2. In an underground traction substation, these feed two twin cylinder GEC steel tank rectifiers with the associated transformers, the latter having a six-phase output with interphase winding, the primaries being connected star and delta so as to give an effective 12-phase rectification. Tertiary windings provide current for auxiliaries but, because of the difference in primary connections, these are not operated in parallel but are selected through contactors on the rectifier control board. The capacity of each twin cylinder rectifier is 1,500 kW.

Fig. 1. The Metropolitano de Lisboa underground system

Switchboards

The 10 kV GEC switchboard comprises seven panels with double-break, vertical isolation, double busbar oil circuit breakers rated at 350 MVA. The eleven panel 3 kV board comprises single-break o.c.b's. rated at 50 MVA and are remote controlled. One circuit is connected to the 850 kVA standby alternator with provision for synchronising; another feeds the transformer to provide 120 kVA of 3-phase 4-wire 380 V supply to the l.t. board which, in turn, comprises 3-pole fuse switches for lighting and workshops, etc. Alternative l.t. supply to this board can be obtained from a 120 kVA transformer on the 10 kV board.

The remote control board comprises the panels for 380 V auxiliary services, the d.c. 220 V battery and emergency lighting, the 3 kV and 10 kV control panels, with a hinged synchronising panel between, and the traction control panel. A mimic busbar diagram with semaphore indicators gives a picture of the state of the system.

High speed circuit-breakers isolate the track from the rectifiers as well as 3,000A pole operated isolators.

Emergency Generator

In the event of a total failure of the Grid supply the diesel-driven alternator, comprising an 850 kVA, 3 kV 3-phase 50 cycle alternator and Davey Paxman 12YLX diesel engine is automatically started up and will provide sufficient current for lighting in the stations and carriages, as well as for the movement of the trains at reduced speed into the stations.

The 220 V battery has a capacity of 152 ampere-hours and provides power for closing and tripping the breakers as well as for substation emergency lighting.

Ventilation of the stations and tunnels and of the substations is partly by forced draught, provided by Woods 48 in. Aerofoil two-stage contra-rotating fans extracting at 27,000 or 20,000 cu ft/min respectively at the two speeds, and partly by the piston effect of the trains as they travel through the tunnels. Thirteen pumping stations, with a total of twenty pumps, the largest having a capacity of 600 gal/min against a head of 75 ft, keep the track and stations free from flood water. Pirelli-General supplied the cables.

ENGLISH ELECTRIC CO.

Progress in Manufacture—1959

THE past year has again been an active one in every department of the English Electric Co. and, with an eye to the future, research and development facilities have been expanded as well. Not the least important of these was the Atomic Power Centre at Whetstone which was opened by Lord Mills, then the Minister of Power, in July where a large new workshop is fully equipped with the latest automatic machine tools and material handling equipment for the machining of graphite moderator components for reactor cores. Other shops are now being finally equipped for the assembly, under strict conditions of cleanliness, of heavy reactor fuelling machinery. Here production of graphite components for Hinkley Point has already commenced.

Facilities for the manufacture of gas turbines have also been expanded by the opening of new shops and test areas for full-load testing of gas turbines up to 8,000 kW rating.

In design and development a notable feature was the extension of type OKM4 33 kV outdoor oil circuit-breakers to cover a rating of 1,000 MVA at 22 kV to come into line with an American NEMA rating for 34·5/23 kV. This enabled the company to secure an order from the Los Angeles Department of Water and Power and so to break in to the US domestic market with this type of switchgear for the first time.

The year also saw the commercial introduction of English Electric silicon rectifiers of high current and voltage ratings while, in the instrument section, the variety and range of instruments relays and meters was extended. In the electrical drive field a new development is the electric motor specially constructed for vibratory drives in which adjustable out-of-balance weights at either end enable amplitudes over a wide range to be applied to equipment requiring vibratory or oscillatory motion.

New portable welding equipments, both for a.c. and d.c. welding, the latter incorporating silicon rectifiers, have been developed and marketed with success during the year.

New Orders

Order books in all departments appear to be replenished at the intake end as rapidly as production empties them by deliveries. Hydro-electric generating equipment, a field in which the company holds a proud record and enviable reputation, has been ordered by the North of Scotland HEB for the Culligran and Deanie stations. At the former the 22 MW turbine is of the variable blade mixed-flow Deriaz type but, unlike previous Deriaz turbines, it is to be used for straight, and not reversible, operation. At Deanie the order is for two 19 MW vertical alternators.

English Electric steam turbo-generators have been in good demand, the CEGB leading the field with an order for two 350 MW sets for Drakelow "C" station and a 120 MW set for Bankside "B." Both have hydrogen-cooled rotors and, in the case of Drakelow, a water-cooled stator. The 350 MW sets will be designed for 2,300 lb/sq in., 1,050°F, with reheat to the same temperature and will be the largest single line turbo-generators in Britain. Bankside will, of course, be at 1,500 lb/sq in., 1,000°F. Abroad, an order has been secured for two 200 MW sets for Vales Point, Australia as well as for smaller sets from S. Africa, Ceylon and the Sudan.

The list of orders for diesel electric sets ranges the whole world, a large proportion also including switchgear and station meters, etc. An impressive list of transformer orders, both large and small, includes two 310 MVA 275 kV units for Thorpe Marsh, the largest yet ordered for service in Britain. Notable orders for switchgear are the CEGB's £1 million contract for Stalybridge switching station which will include the supply of five 275 kV, 7,500 MVA and 16 132 kV, 3,500 MVA air-blast breakers.

In the marine field an order for the 3,270 s.h.p. diesel electric propulsion machinery for the new Cables and Wireless cable repair ship is also worthy of note.

Orders Completed

Dispatch and outdoor erection departments have been extremely busy during the year keeping the shop floors clear of completed equipment and getting it to an operative state on site. Three of the ten 91 MW hydro-electric sets for Priest Rapids, on the Columbia River, USA, have been commissioned, the first in October, the second in November and the third in December. At Table Rock the first two of four 68,000 h.p. turbines have been commissioned, the first, it is believed, of foreign manufacture to be supplied to drive American made alternators.

In Australia all four 135,000 h.p. Francis turbines have been commissioned, the most powerful high head (1,095 ft) machines of this type in the world. Then come the three 36·8 MW sets at Hirfanli, Turkey, two 18 MW sets at Tully Falls, Australia, a 35 MW set at Silvon, Spain, and an 11 MW set at Cashlie, Scotland, all commissioned and running.

Being erected are the four 105,000 h.p. pumps and turbines for Ffestiniog Wales, the largest pumped storage project in the world, and the 50 MW set for Warragamba, Australia. In Canada, the John Inglis plant has commissioned three of the 200,000 h.p. Francis turbines at Chute-des-Passes and nine of the 16 75,000 h.p. propellor turbines in the Robert H. Saunders station on the St. Lawrence Seaway. Five of the ten units of identical design ordered for Beauharnois No. 3 have also been commissioned. The remainder at both stations are in an advanced stage of construction or erection.

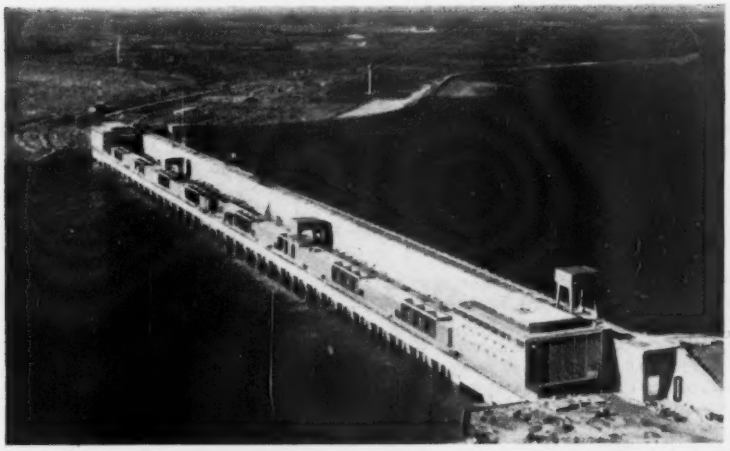
Steam turbine sets commissioned during the year included the first 200 MW High Marnham set for the CEGB notable in that this machine operates at the exceptionally high steam pressure of 2,350 lb/sq in.—that is, more than one ton per sq in. Other units commissioned were the fourth 100 MW set at Willington, officially opened during the year, two 60 MW sets at Belvedere and, overseas, a 66 MW set at Queen Elizabeth station of the Saskatchewan Power Corporation, a 45 MW set at Halifax, Nova Scotia and others in South Africa, New Zealand, Malacca and Penang.

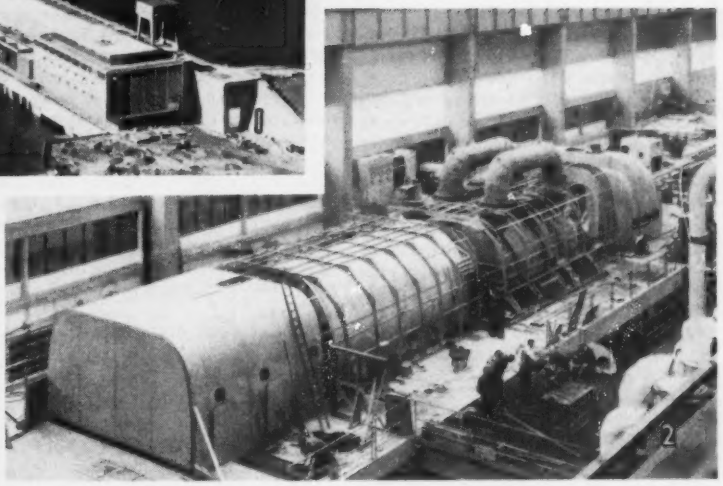
Transformers completed, delivered and commissioned include the first 210 MVA 275 kV unit for High Marnham and the 330 kV transformers for Kariba, the latter marking the successful end of a long and difficult transport operation.

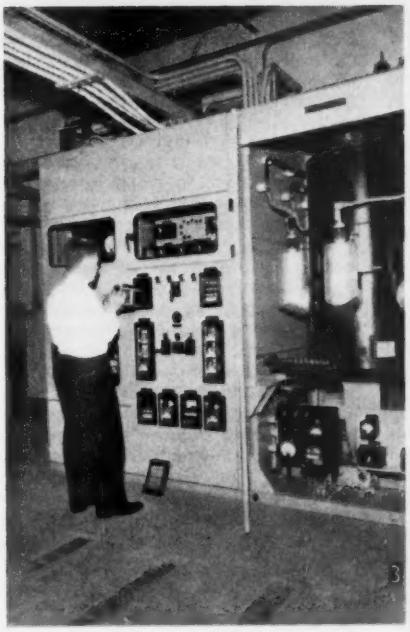
In all other departments similar long lists of successfully completed work marks the trail of 1959 and as the company enters the new year, the work in hand still shows no sign of falling off.

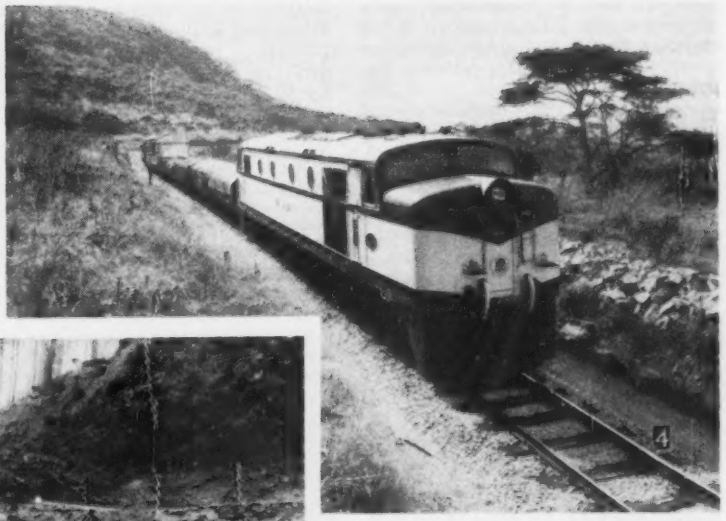
Diesel electric and electric trains both for main and local lines at home and abroad have gone into service during 1959 which, incidentally saw the introduction of the first a.c. multiple unit passenger service at 25 kV on the BR Colchester-Clacton line. The company is the only one to supply all five of the standard BT diesel-electric locomotives ranging from 1,000 to 3,300 h.p. for British Railways. Abroad, English Electric rectifiers are supplying d.c. for traction and, of course, diesel electric locomotives as well.

Deliveries in the marine field include main propulsion steam turbines and condensers for the prototype nuclear submarine installation which Vickers-Armstrongs are developing at Dounreay as well as turbines for naval vessels and electrical propulsion equipment for a submarine. Sales of domestic appliances have also been maintained in 1959.









1. The International power station on the St Lawrence Seaway. Sixteen 75,000 h.p. English Electric turbines drive the generators in the Robert H. Saunders station in the foreground

2. The first 200 MW turbo-alternator being installed in the High Marnham (CEGB) station. There will be five in the completed station

3. A 2,500 kW 1,500 V d.c. English Electric steel tank rectifier at Woy Woy, N.S.W. for driving the trains on the electrified Northern Line

4. An English Electric 2,000 h.p. diesel locomotive in Rhodesia drawing a train carrying a 60 MVA transformer for Kitwe

5. The arrival of the first 80 MVA 18/330 kV English Electric generator transformer at Kariba

equipment for industry

Invisible detector beam

INFRA-RED rays are used to actuate a detector in a recently introduced warning system. The system has been designed for situations where warning of approach of unauthorised persons is required without their being aware of detection: possible applications for the system are numerous but banks and service installations are obvious examples. The infra-red beam is produced by a projector with a revolving shutter arranged to interrupt the beam about 700 times per second. It is claimed that by so interrupting the beam, spurious warnings resulting from snow flakes falling past the detector, or car headlights sweeping across it, are eliminated. A projector, which includes the rotating shutter with lens, is housed in a die casting with an external pushbutton for operating a lens screen to change from visible light to infra-red emission. The other two units are the detector, which is tuned to the same frequency as the projector shutter, and a box containing a contactor suitable for operating external circuits rated at 5 A 240 V. The equipment is of French manufacture and is claimed to have a range of 550 yd. A 240 V single-phase supply is required.

The same company are also marketing a latching relay with silver contacts claimed to be suitable for 6 A at 240 V a.c. The relay measures 1⅞ in. by 1½ in. by ⅞ in. and consumes 5 VA. Information concerning these two products can be obtained from *British Central Electric Ltd., 6/8 Rosebery Ave, E.C.1.*

Soldering accessory

EVEN in these days of highly complicated machines, there is still plenty of scope for a simple device which will speed production. Such a device has recently been introduced by a manufacturer of soldering irons. It is a simple stand which can be attached either to a wall or bench and which will accommodate a reel of solder. The stand is priced at 12s 6d. It is intended for use with a 230/240 V soldering iron which can be supplied with five interchangeable bits. One of these bits has been devised for transistor work and is only 0·04 in. diameter. The soldering iron and stand made by *Antex 7/8 Idol La, E.C.3.*

Local/remote motor starting

MOTOR starters in the Dewhurst and Partners TF range, described in ELECTRICAL TIMES for 24 Dec. as being fitted with an hand/off/auto switch, will continue to be available without this switch for those customers not requiring the feature.

Miniature sealed relay

FAST operation, long life, and high contact rating are some of the features claimed for a Danish-made sealed relay now available in this country. The relay is hermetically sealed in an atmosphere of nitrogen and precautions have been taken against corrosion of the gold-plated silver contacts by using a special ceramic material for the coil former. The relay has a double coil construction with two changeover contacts operated by a rotary armature. Type RZO relay is supplied with either hook terminals or a plug-in base. Further details may be obtained from *Counting Instruments Ltd., 5 Elstree Way, Boreham Wood, Herts.*

Flameproof range extended

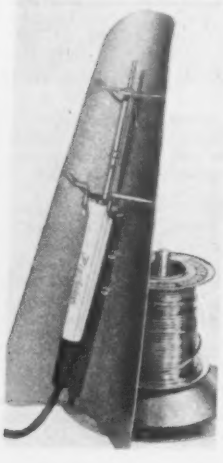
FLAMEPROOF three-phase distribution transformers up to 20 kVA are now available from one manufacturer. The transformers are covered by Ministry of Power flameproof certificates and are suitable for groups 1 and 2 gases. The range of flameproof transformers manufactured now includes lighting transformers up to 1 kVA at 3·3 kV, mobile units up to 500 kVA at 11 kV, and the extended range of distribution transformers up to 20 kVA at 3·3 kV. These transformers are made by *AEI Ltd., Transformer Division, Manchester.*

Silicon diodes

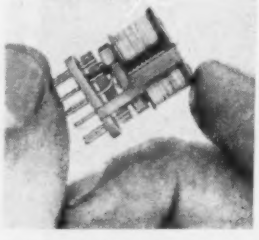
SILICON diodes rated from 200 to 500 mA and suitable for 400 peak inverse volts are now available at low cost. These new rectifiers are intended for operation in ambient temperatures of 70°C and are designed with a multi-seal construction said to give them good shock and vibration resistant properties. *International Rectifier Co. (Gt. Britain) Ltd., Hurst Grn, Oxted, Surrey.*

Bezel-level dial meters

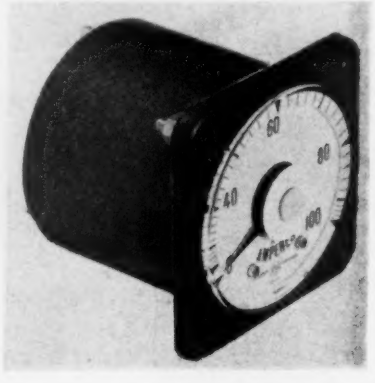
IT seems that musicians and composers are not alone in being inspired by the words "New World," for one instrument manufacturer has recently applied this title to a range of switchboard meters. The meters have a curved glass front permitting the scale to be in the same plane as the meter bezel. This arrangement is claimed to give a shadowless scale which can be easily read over an unusually wide viewing angle. The design conforms to current practice in North America and Canada and has been used on a number of meters supplied to those countries. The curved glass has been carefully designed to avoid distortion of the meter reading when the scale is viewed at an angle, and in addition a platform scale is used to eliminate parallax errors. The slightly projecting moulded glass front is contoured to prevent light striations across the meter dial and the engraved figures are rather bolder than usual. The meters are nominally 4 in. with a 3½ in. dial and can be supplied as moving iron or moving coil voltmeters and ammeters, wattmeters, frequency speed and power factor meters. They are made by *Crompton Parkinson Ltd., Crompton Hse, Aldwych, W.C.2.*



Antex soldering iron bench stand has solder reel holder. The stand is also suitable for wall fixing and accommodates the five bit irons made by the company



Miniature high speed relay type RZO before sealing in nitrogen-filled container



Angle view of the New World meter made by Crompton Parkinson showing the scale reading through the edge of the moulded glass dial. The dial is raised to avoid shadows being thrown on the platform scale

for the electrical trade

Radiant rings down

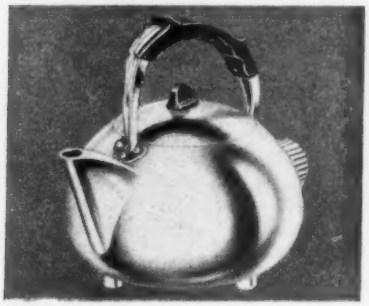
REDUCTIONS in the prices of radiant rings to electricity boards for replacement purposes are announced by AEI-Hotpoint with an increase in the guarantee period to two years dating from the date of installation.

The 1960 range will comprise circular single-heat models for "Simmerstat" or equivalent control in the 6¼ in. size (1,350 or 1,100 W) and in the 8 in. size (1,350 or 1,100 W). Three-heat models will also be available in the same sizes and loadings and, in addition, in 7 in. (1,200 or 1,500 W) and 8⅛ in. (2,000 W) sizes. The range is completed by two three-heat 8½ in. by 6 in. rectangular models loaded to 1,600 W.

All of these can be supplied either as plug-in units to EDA standard, as coils, terminal-box and reflector or as complete assemblies of coil, terminal-box, reflector and support. Voltage ranges are the standard 200/210, 220/230, 230/240 and 250 V. The high loading, small tube 2,300 W 8 in. and 1,350 W 6¼ in. will not be available for a little while but other models can be supplied on demand. Full prices and other technical details can be obtained from *AEI-Hotpoint Ltd., 33 Grosvenor Pl, London S.W.1.*

New electric kettles

TWO inexpensive additions to the Diamond range of domestic utensils are announced. They are the "Streamline" and "Popular" electric kettles in highly polished aluminium, both with internal heating elements loaded to 1,500 W with automatic safety cut-out, connector with earthing device and guaranteed for 12 months. The "Popular," priced at 51s 3d, is a conventional swan neck outlet pattern with lid; the "Streamline," as the illustration shows, is a modern, rounded shape with wide entry outlet, which is not likely to become choked with lime in hard water districts; with a well-shaped handle and lid it is priced at 63s 9d.



The "Streamline" kettle, one of two new models with a loading of 1,500 watts, just released by the London Aluminium Co. for 200/220 or 230/250 V supplies

Both kettles are supplied in attractive cartons and the makers are *The London Aluminium Co. Ltd., Holloware Div., Charles Henry St, Birmingham 21.*

New table cooker

ANOTHER aspirant in the table cooker stakes is the "Presto" griddle-hotplate, which serves the double purpose of a grill or dry-frying appliance with that of a food or plate warmer when the food is cooked. The loading is 1,500 W and it is designed for operation with the Control Master variable heat control unit, containing a thermostat, pilot light and adjustment dial, which automatically regulates the temperature of the appliance for cooking or to lower temperatures for plate warming. When finished with, the hotplate, detached from the Control Master, can be completely immersed in water for cleaning without harming the element.

The dimensions of the griddle-hotplate, tastefully designed for table use, are 17½ in. by 10 in. and it carries a year's guarantee. The list price has been fixed at £9 13s including p.t. complete with metal vented lid and deliveries will commence shortly. The Control Master, which also is usable with other "Presto" appliances, is listed at £2 2s 6d including p.t. The makers of "Presto" appliances are *The National Pressure Cooker Co. Ltd., Wolverhampton.*

TRADE PUBLICATIONS

BIRLEC.—Eight-page booklet (Pub. 501), "General Purpose Electric Box Furnaces," from AEI-Birlec Ltd., Erdington, Birmingham 24.

DORAN.—Two leaflets on d.c. potentiometers (List 119) and a.c. mains unit for the Unicam spectrophotometer (List 120), from Doran Instrument Co. Ltd., Stroud, Glos.

EKCO.—72-page catalogue of nucleonic equipment (EC.60) by Ekco and Dynatron, from Ekco Electronics Ltd., Southend-on-Sea, Essex.

GORDON.—Eight-page booklet (Cat. 181) on Gordon indicating and recording flowmeters, from James Gordon and Co. Ltd., Dalston Gdns, Stanmore, Middx.

ICI.—12-page technical summary No. 3 on the corrosion resistance of ICI Titanium from Imperial Chemical Industries Ltd., Metals Division, P.O. Box 216, Birmingham 6.

LINOLITE.—24-page catalogue (No. 39) of Linolite fittings, strip reflectors and signs, from Linolite Ltd., The Mill Works, Malmesbury, Wilts.

MARCONI. — Eight-page booklet (Ref. SP.80) on military command communications with the HS27/HR27 Marconi mobile wireless station, from Marconi's Wireless Telegraph Co. Ltd., Chelmsford, Essex.

PYE—Eleven application sheets (Ref. Nos. pH/1 to pH/10 and TI/1) giving detailed technical information on the application of Pye Universal and Dynacap pH meters in various industrial processes and the use of the Pye Automatic Sulphur Determination Apparatus, from W. and G. Pye and Co. Ltd., Granta Wks, Cambridge.

STC.—Four-page technical data sheet (C/2042, Ed. 1) on the transistor two-wire audio repeater, from Standard Telephones and Cables Ltd., Transmission Div., North Woolwich, London E.16.

SWIFT.—Eight-page broadsheet with insert price list on cable trunking and components, from Swift's of Scarborough Ltd., Olympia Wks, Durham St, Scarborough.

TCC.—Three technical bulletins: No. 67, "Miniature Tropical Paper Condensers"; No. 59, "Miniature Tantalum Anode Condensers"; and No. 29, Series 2, Issue 2, "Fixed Ceramic Transmitter Condensers," from Telegraph Condenser Co. Ltd (Radio Div.), North Acton, London W.3.

Electrolux 65 cleaner

THE name "Electrolux" is well known in the suction cleaner field for their pioneer developments in the enclosed dust-bag type of appliances which have been copied extensively since their introduction. It is now more than 35 years since the first of their cleaners appeared and, with each new model, there have been advances in design to a point at which it would seem impossible to go further. Yet, somehow or other, they have again been able to introduce features in the latest of the family, the Model 65, which must enhance their appeal to housewives whether or not they are already converted to the use of an "Electrolux."

Features which have been retained are, of course, the whisper-quiet motor, the flexible, tapered hose to minimise risk of choking, the hygienic throw-away dirt bags for easy disposal and the air purifying pad and filter on the outlet and the traditional "Electrolux" design of container. Improvements in styling include new cream plastic end caps with the best "easy-to-open" clips yet seen; washable p.v.c. exterior to the tube and

The new "Electrolux" Model 65 with (inset) the ingenious two-purpose dusting tool

casing, the latter in a delightful shade of pink; new handle for carrying incorporating, with a groove in the end cap, a simple and efficient flex storage arrangement; positive tube coupling and metal sleighs with nylon rollers positioned at the centre of gravity for ease of manipulation while cleaning. The cleaning tools have now been reduced, by cunning design, to two only for general purposes. The extension tube is now telescopic enabling its length to be adjusted to the job in hand. A floor brush which swivels to enable it to be used under the lowest furniture with ease has a two-position, toe-touch adjustment for carpets or polished floors. The second tool is a soft dusting brush with two wings which can be reversed to make an upholstery cleaning attachment in a matter of seconds. The weight of the cleaner is 13¾ lb with the flex. The "65" will be supplied with 12 disposable dust bags as well as a fabric bag, which not only reinforces the paper bags but can be used as a dustbag itself should the housewife find herself out of replacements, and an extra filter. The 65 is now guaranteed for two years. The price, £29 11s 5d includes £4 11s 5d purchase tax. The makers are, of course, *Electrolux Ltd., 419 Oxford St, London W.1.*

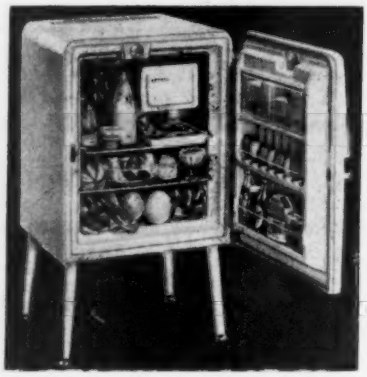
Cooker prices

ON page 23 last week, in referring to the 494 "Jackson" cooker there appeared the sentence "listed at £56 is probably the lowest priced four-plate cooker on the British market today." This should, of course, have read "is *among* the lower priced four-plate cookers" for, as readers of these columns will recollect, the Creda "Mercury Four," described on page 241, 17 Sept. last, is also a four-plate cooker with a grill in the oven and is listed at 49 gn. The "Mercury Four" is illustrated below. It is a product of *Simplex Electric Co. Ltd., Creda Hse, Binney St, London, W.1.*

The Creda "Mercury Four" with four sealed-in hotplates and oven grill. Price 49 gn

'Fridge on legs

THE new "Astral" table model refrigerator with a 2 cu ft capacity is almost identical in size with the 1·5 cu ft model BM/E which it replaces, the increased capacity having been obtained by new techniques in design. It has a shelf area of 4·2 sq ft and storage capacity for frozen foods up to 5 lb. The dimensions are 25½ in. high by 21¼ in. square and the absorption unit, guaranteed for five years, takes 95 W. The price of the unit as a table model is £36 15s including p.t., but it can be converted to a smart free-standing refrigerator by the addition of contemporary styled legs at the modest price of 29s. "Astral" refrigerators are distributed by *Morphy Richards Ltd., Foots Cray, Kent.*



The "Astral" table refrigerator A.200 A, 2 cu ft capacity converted to a free-standing model

BRITISH STANDARDS

Braided Travelling Cables for Electric Lifts. *BS 977 : 1959. Price 4s.* This is a complete revision of the 1941 standard which is far more comprehensively drafted and extends the permissible insulation to cover polychloroprene and vulcanised rubber as defined in BS 2899. A colour scheme for braids and details of a flexibility test apparatus are also included.

Fixed Carbon Resistors for Telecommunication and Electronic Equipment. *BS 2112 : Part 1 : 1959. Price 10s.* This is the first of a two-part standard which deals with requirements and tests for fixed carbon resistors having a dissipation not exceeding 3 W at 70°C and of rated resistance between 10 and 10^7 ohms. The second part will list standard sizes and ratings.

The resistors for which it applies are those intended for use over an ambient temperature range of −40°C to +100°C, in one of the four humidity classes H1 to H3A of BS 2011. In addition to the tests for suitability over the stated temperature and humidity ranges, the standard covers tests to establish ability to withstand mechanical shock in transit or under operational conditions and their stability during and after assembly processes, such as soldering, into equipment. An appendix lists the colour coding originated by the RMA of America and adopted by the British industry and the Services.

Cables for vehicles. *BS 1862 : 1959. Price 7s 6d.* Dealing, as in its earlier edition, with both ignition cables and cables for the lighting, starting and auxiliary winding of road vehicles, this new edition introduces a p.v.c. insulated ignition cable and also changes the stranding of rubber-insulated ignition cables. Its range of p.v.c. insulated light-duty cables has been extended to include single-core cables without further covering and twin- and three-core cables insulated and sheathed with p.v.c. In some sizes, alternative conductors are now given to provide for greater and less flexibility. Particulars of bare earthing braids are now given for the first time. Test requirements are generally similar to those specified previously, but have been extended to include tests in lubricating oil, fuel oil and petrol for p.v.c. insulated l.v. cables. Moreover, the standard now requires that no oil may penetrate the lacquered braid of rubber-insulated l.v. cables.

Electronic-valve bases, caps and holders. *BS 448 : Sections B5G/F and B7E/F. Price 2s each.* These two new sections of BS 448 specify the base and bulb outline dimensions of the B5G/F and B7E/F sub-miniature valves with flexible connecting leads. Gauges for checking lead spacing and bulb outline dimensions are also specified.

Thermostats for use with domestic electric cookers (a.c. only). *BS 3180 : 1959. Price 4s 6d.* This is a new document, laying down requirements for performance, methods of test and safety of single-pole, single-circuit thermostats intended for the control of ovens of domestic electric cookers operating on supplies up to 250 V a.c. It specifies a thermostat operating range of at least 200°F to 550°F, but requires the part inside the oven to withstand occasional heating to 600°F. The remainder of the thermostat, and its auxiliaries, is required to be capable of operating in an occasional ambient of 255°F. Operating accuracy is specified as 15°F at the calibration point, and 30°F at the upper and lower ends of the range. Tests laid down include those for dielectric strength and insulation both when hot and after humidity conditioning, together with endurance and accuracy of calibration and range.

Copies of the above-mentioned standards may be obtained on application to the British Standards Institution (Sales Branch) at the prices stated. Postage is charged extra to non-subscribers.

Plans for Industrial Radiation Regulations

DRAFT regulations for the protection of workers who might have to use or be near sealed sources of ionising radiation, such as radioactive isotopes, were issued for comment in July of 1957. Now the Ministry of Labour has published a revised draft of appropriate regulations, taking into account the many comments received on the earlier document. Closing date for receipt of comments on the present draft is 15 April next.

The regulations are in the form of a statutory instrument drawn up in five parts. The first of these is concerned with interpretation and general matters, while the second covers widely-applicable precautions. They require notice to the factory inspector when ionising radiations are to be used in a factory for the first time. Where they are used, it is required that radiation dosemeters shall be provided, and records of measurements kept. There are provisions as to the maintenance and storage of sealed sources of ionising radiations, and for a register of them. Appointment of named "competent persons" to exercise special supervision with regard to the requirements of the regulations is required.

Part 3 of the regulations deals with the testing of personal exposure to ionising radiations, and requires as the minimum the wearing of film badges and their evaluation by approved laboratories. Blood examinations of those employed on processes using the radiations are required, and tests are prescribed in some detail.

Parts 4 to 6 of the regulations are concerned with stated processes, including the use of ionising radiations in radiography. They deal with shielding and with signals and warning lights in X-ray chambers and the like. For gamma ray sources, there is a limit of 1% on the proportion of the primary beta rays to be allowed to escape. For X-ray machines, there are separate requirements about interlocking and switching the electricity supply.

Static eliminators, thickness gauges and the like are also dealt with separately, with detailed attention to the way they are to be installed and marked.

The new draft includes notes on the changes made since 1947. These include a number of revised definitions, provision to deal with contractors' men and the like temporarily in a works using ionising radiations, and a substantial change in the range of workers who would be required to undergo medical supervision. There is also a revised schedule on maximum permitted radiation doses.

The draft regulations are obtainable from HMSO, price 1s 3d.

FUNDAMENTAL CAPACITOR

FUNDAMENTAL investigations to establish a foundation for the whole structure of electrical standards, in order to improve the accuracy of up-to-date electrical measurements have recently been carried out by the US National Bureau of Standards. The basis for the new approach is a capacitance measuring bridge and an accompanying calculable standard of capacitance. This advance allows the electrical quantities of resistance and voltage to be determined by alternative procedures, and provides a check on the ohm and the volt as currently maintained by the Bureau. All the other electrical units in use today may be derived from these two basic units.

There are many relationships between electrical and mechanical phenomena which offer possible methods for realising units by means of mechanical measurements. However, until recently only one relation could be exploited with the required accuracy. This is the dependence of the inductance of a circuit on its geometric size and shape. The Bureau has therefore been using this relation to realise the basic units of electrical measurement, the ohm, and the ampere, with the volt derived from Ohm's law. The absolute ohm is based on a computable self or mutual inductor, and the absolute ampere is based on the calculated force between two carefully constructed current-carrying coils.

Realisation of the ohm in terms of the computable capacitor involves comparing a resistive impedance with a capacitive impedance. The capacitance is adjusted until the current through it balances the current through a resistor when the two impedances are connected to voltage sources equal in magnitude but differing in phase by 90°. This allows a value to be assigned to the resistor in terms of the known capacitance and the frequency of measurement.

Standard resistors used in maintaining the ohm are not suitable for use with alternating current. A critical part of the new determination is therefore the construction of a comparison resistor which will have the same value at the comparison frequency as when used with direct current.

A realisation of the absolute volt through capacitance measurements is also being considered. This determination, like that of the ampere, will be based on a force measurement. Here the force between plates of the capacitor is proportional to the square of the impressed voltage, and to the rate of change of capacitance with displacement. It is expected that measuring this force will provide a realisation of the volt with an accuracy at least as high as, and probably higher than, present absolute-ampere determinations.—*From a contributor.*

Fig. 1. Transfer resistor used in connection with capacitor bridge

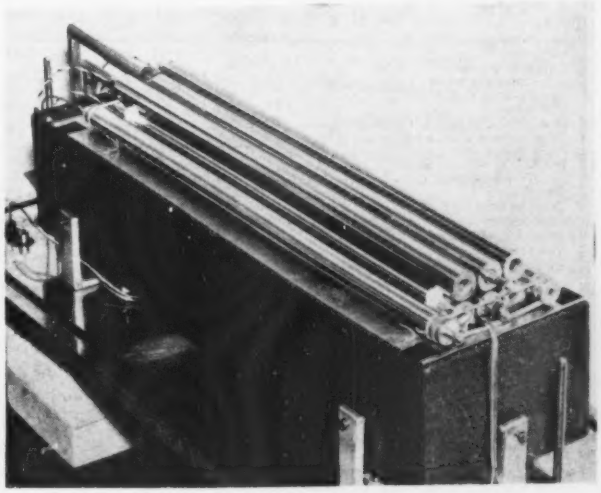


Fig. 2. The adjustable capacitor for absolute unit measurements

News of the Week

APPLIANCES SHOW "STRIKING ADVANCES" IN NEW B.E.A.M.A. SURVEY

Washing Machines up 70%, Refrigerators 60%

MANUFACTURERS' deliveries of domestic electrical appliances during the third quarter of 1959 are itemised in a new statistical analysis issued by BEAMA. The figures show, BEAMA claim, that the "striking advances" of the first half of the year were maintained, and confirm forecasts that 1959 would see a record year for the electrical appliance industry.

Washing machines were up by 70% on the third quarter of 1958, while refrigerators showed an increase of 60%. Vacuum cleaners, electric blankets and electric irons all made notable gains.

The substantial increase in deliveries to the home market, however, has not extended to the export market, BEAMA point out. During the three months ended 30 Sept., 1959, the value of appliances delivered to the home market, totalling £28½ million, was nearly ten times the value of exports, which stood at just under £3 million.

The figures (given in the table below) include certain appliances for which statistics were not previously collected, such as spin and heated tumbler dryers, and this data is of particular interest.

Details of refrigerator deliveries are not yet available for the three months concerned, but will be given for subsequent quarterly periods.

In issuing this new three-monthly return, BEAMA are taking over responsibility from the Board of Trade, who discontinued the collection of detailed statistics on domestic electrical appliances last July. As the figures embrace all but a small part of the industry, they provide a reliable picture of the state of the appliance field, and will be issued regularly on a quarterly basis.

Manufacturers' deliveries of appliances for three months ended 30 Sept., 1959

Appliance	Home Market		For Export	
	Thousands	Value £000s	Thousands	Value £000s
Blankets	399	969	2·4	6·1
Cookers, domestic:				
(a) below 5 kW	29	338	2·0	16·7
(b) 5 to 12 kW	102	3,555	3·3	94·2
Dishwashers	2	169	0·3	13·2
Fans, desk and ceiling, below 1/10 h.p.	—	166	—	277·2
Floor polishers and scrubbers	5	67	14·1	126·2
Hand hair dryers	109	201	9·2	17·3
Irons: (a) non-automatic	60	40	7·8	6·5
(b) automatic	496	862	138·9	206·1
Dry shavers	233	1,002	48·9	241·1
Space heaters up to 3 kW	692	2,270	18·9	63·4
Spin dryers	59	1,050	8·7	117·6
Heated tumbler dryers	6	169	0·2	4·5
Toasters	51	155	18·5	58·5
Food-and-drink mixers up to 3-qt. capacity, including hand held	15	212	8.0	103·3
Vacuum cleaners	336	4,570	41·6	393·5
Washing machines, including:				
(a) those with hand or power wringers	174	6,607	19·6	462·9
(b) those combined with a spin dryer	95	5,096	19·5	722·2
Water heaters:				
(a) immersion (up to 3 kW)	200	299	7·8	6·6
(b) storage (up to 30 gal.)	38	394	3·9	56·4
Washboilers (up to 10 gal.)	50	376	0·3	2·7
Total Value for Home and Export	£28,567,000		£2,996,200	

More in A.E.I. Woolwich Group

FOUR other companies have now been grouped under the management of Associated Electrical Industries (Woolwich) Ltd. They are: London Electric Wire Co. and Smiths Ltd.; AEI Plastics (Aldridge) Ltd. (formerly Aldridge Plastics Ltd.); Henley Foundries Ltd.; and the Fixed Price Light Co.

As we earlier reported, AEI (Woolwich) Ltd., which began operating at the beginning of this month, is responsible for managing four new Product Divisions of AEI, namely, Telecommunications, Radio and Electronic Components, Cables, and Construction (cables and lines). The board of management of the group is noted on page 57.

Kenwood name for Stock Exchange

THE name of Kenwood will be quoted on the Stock Exchange from 28 January onwards if shareholders of Peerless and Ericsson Ltd., the parent company, approve at an extraordinary general meeting to be held on that day. It is proposed to change the name of the parent concern, which is a public company, to Kenwood Manufacturing Co. Ltd., and at the same time the company at present bearing this name will become Kenwood Manufacturing (Woking) Ltd. This move follows the recent merger in which Peerless and Ericsson acquired all the Ordinary share capital of Kenwood.

The Kenwood group claim that they now manufacture a range of domestic and kitchen appliances which is among the most comprehensive in the world. The original company was formed 13 years ago by Mr Kenneth Wood, 43-year-old managing director of the group, with a capital of £800 and two employees.

Today, with factories at Woking, Birmingham and Coventry, the group has more than 1,400 employees and an annual turnover of several million pounds. More than half of its products are exported overseas.

This year the Kenwood subsidiary in Australia will start production at its new Adelaide factory.

Edmundsons' latest

THE Glasgow wholesalers, T. Stanley Weston and Co. Ltd. have joined the Edmundsons group of companies. Incorporated in 1931, the firm specialises in lighting fittings and domestic appliances. Mr T. Stanley Weston, who is chairman of the Scottish Section of the EWF, continues as company director.

Hunterston Standstill ends

AGREEMENT on a wage structure was finally reached last week between the Boilermakers' Society and the Motherwell Bridge and Engineering Co., who are responsible for building the reactor spheres and steam-raising vessels at Hunterston nuclear power station. Work resumed on Monday.

The company reopened their part of the site last Monday, and work is now continuing on the £8 million contract. Agreements with the five other unions involved have already been concluded.

The station, which is being built by GEC for the S of SEB at a cost of £40 million, is more than a year behind schedule. The Motherwell company suspended operations on 27 Sept. because, they said, of "persistent industrial misconduct" by their employees. There had been 32 unofficial strikes in 18 months. As we reported in our 31 Dec. issue, the company had been prepared to abandon its contract if agreement with the boilermakers could not be reached.

£8m Chinese Contract for 5 U.K. Cable Firms

FIVE British cable firms are to supply the China National Metals Import Corporation with £8 million worth of copper wire rods under one of the largest contracts ever placed in the UK by China. The contract has been divided between British Insulated Callender's Cables, Enfield Rolling Mills, Richard Johnson and Nephew, Pirelli General Cables, and Frederick Smith and Co., so that each firm receives an order for more than £1 million.

Engineers' Hours and Pay Claim

THE campaign in support of the claim for a 40-hour week and increased wages in the engineering industry is expected to be stepped up almost immediately following last week's meeting of the executive of the Confederation of Shipbuilding and Engineering Unions.

Only three days earlier Sir Kenneth Hague, president of the Engineering and Allied Employers' National Federation, had intimated that they were unable to offer more than a reduction to a 42½-hour week, provided the wage claim was dropped, without the approval of a majority of member-firms of the Federation.

All members of the Federation are this week receiving a report of the deliberations with union officials, and their reactions are to be put before the latter on 26 January.

Meanwhile, some action seems likely on the shop floor as the result of meetings of shop stewards arranged throughout the country by the Confederation's district committees.

SIMPLEX MOVE

THE headquarters and administrative staff of Simplex Electric Co. has now moved to the company's head office at Creda Works, Blythe Bridge, near Stoke-on-Trent. This is part of a rationalisation scheme involving transfer of departments and operations with a view to improving production efficiency at the firm's Olbury and Blythe factories.

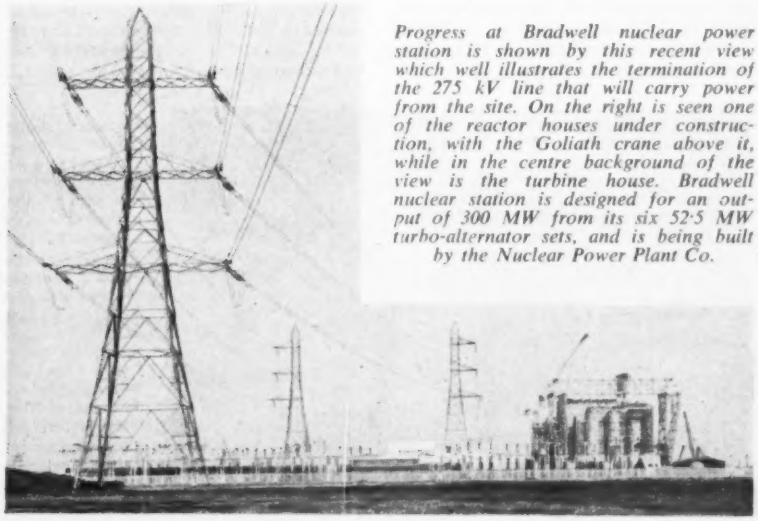
G.E.C. IN PIPED TV PROJECT

A NEW company, General Piped Television Ltd., has been formed by J. F. Thomasson and Co., merchant bankers, to provide a wired television relay system throughout the country. Controlling interest in the company, which has an authorised capital of £100,000, will be acquired by Pillar Holdings Ltd. Full technical facilities for signal distribution are to be provided by GEC, who are subscribing for shares in the new company.

The directors are: B. L. Arnold, of Piped Television (Wales) Ltd.; M. M. Macqueen, of GEC; J. R. Stopford and J. F. Thomasson, both of Pillar Holdings.

General Piped Television is an extension of the system already operated by Piped Television (Wales), an existing subsidiary of Pillar Holdings. The service will provide guaranteed reception over a wired network, the public being able to choose any make of receiver from their local television dealer.

A similar organisation, Multisignals, was set up last year by Thorn Electrical Industries, E. K. Cole and Ultra, with EMI as technical adviser.



Progress at Bradwell nuclear power station is shown by this recent view which well illustrates the termination of the 275 kV line that will carry power from the site. On the right is seen one of the reactor houses under construction, with the Goliath crane above it, while in the centre background of the view is the turbine house. Bradwell nuclear station is designed for an output of 300 MW from its six 52·5 MW turbo-alternator sets, and is being built by the Nuclear Power Plant Co.

Rolls-Electromatic Link ?

THE name of the Electromatic Washing Machine Co.—the direct sales concern—has been strongly linked with that of the Rolls Razor Co. in recent rumours around the Stock Exchange. Dealings in Rolls Razor shares were suspended last Friday after a big jump in price, "pending clarification of the position." It has been stated by the Equity and Share Co. (London) who made an offer for the shares of Rolls Razor last month, that negotiations with a domestic appliance organisation for manufacture and distribution of its products by Rolls Razor were in hand but had not yet been concluded. It is suggested that Electromatic is the concern in question, but confirmation of this was not forthcoming earlier this week.

Sales Drop

SALES of electrical and radio goods by independent retailers dropped by 10% in Nov. to an index figure of 116, according to BoT. Sales by department stores rose 5% to an index of 151.

Crompton re-join C.M.A.

On 1 Jan. Crompton Parkinson Ltd. rejoined the Cable Makers' Association. The firm first became a member of the CMA in April, 1937, but ceased its membership in April, 1957.

ULTRA TRADING SUBSIDIARIES

TRADING of the Ultra group, of which the parent company is Ultra Electric (Holdings) Ltd., is to be carried on by two subsidiary companies. Ultra Electronics Ltd. will take over the activities formerly carried out by the Special Products Division, while Ultra Radio and Television Ltd. will be concerned with domestic radio and television and have as its subsidiary Pilot Radio and Television Ltd.

Mr Edward E. Rosen, who formed the original company 40 years ago, will continue as chairman of the holding company and of the subsidiaries. Mr A. V. Edwards, who has been assistant managing director during the past 18 months, becomes managing director of the holding company and the subsidiaries.

Other members of the subsidiary boards are: *Ultra Electronics*—L. R. Crawford (general manager), Dr F. W. Stoneman (chief engineer), J. S. Williams (works manager), E. R. Wright (commercial manager). *Ultra Radio and Television*—T. C. Standeven (general manager), A. Bamford (technical manager), W. H. De Val (works manager). Mr Standeven is also on the board of Pilot Radio and Television. Mr J. Irving continues as secretary of the Ultra holding company and the subsidiaries.

Lectures on Selling Light

A COURSE of three lectures on Selling Light, intended for the staffs of electrical contractors and others selling lighting equipment, will be held at Cook's Hotel, Old Steine, Brighton, this month and next. Details are:

26 Jan., *Lamps and Fittings,* by A. D. S. Atkinson; **2 Feb.,** *Displaying Lighting Equipment,* by R. Monery; **9 Feb.,** *Selling Lighting,* by M. F. Sillett.

The lectures, which are arranged by the British Lighting Council, will begin at 6.30 p.m., with refreshments at 6 p.m. Inquiries to the BLC at Brettenham Hse, 16-18 Lancaster Pl, W.C.2.

Pay rise for U.K.A.E.A. Manual Workers

WAGE increases for their manual workers were agreed by the UKAEA at a meeting of the general purposes committee of their National Joint Industrial Council on 6 Jan.

Craftsmen will receive 10s 6d more a week, and general workers 9s. The new rates take effect as from 4 Jan. The trade union side gave an assurance that the standard working week would remain unchanged.

OFFICIAL PUBLICATIONS

Model Form of General Conditions of Contract, including form of agreement, recommended by I.E.E., I.Mech.E., and A.Cons.E., for export contracts. 4s 6d (see this page).

BS 3187. Electrically Conducting Rubber Flooring. 4s.

BS 3179. Comparison of British and Overseas Standards for Steels. Part 1. Chemical Composition of Wrought Carbon Steels. 6s.

Factories (Ionising Radiations) Special Regulations. Ministry of Labour. 1s 3d (see page 67).

New Model Form for Export Contracts

A REVISED version of Model Form B2, *General Conditions of Contract (including form of agreement) for use in connection with export contracts, delivery FOB, CIF or FOR, with supervision of erection,* is now available. It is published jointly by the Institution of Electrical Engineers, the Institution of Mechanical Engineers and the Association of Consulting Engineers.

The original Form B2, first published in 1925, dealt with both the supervision and the complete erection by contractors of electrical plant only. In 1954 Form B3 was published, covering the complete erection only of both electrical and mechanical plant under export contracts. The new Form B2 complements B3 by dealing with the supervision of erection of plant, both electrical and mechanical; thus B3 and the new B2 together replace the original and now obsolete Form B2.

The text of the new form has been reworded to take in the mechanical engineering side and confine the terms of reference to the supervision of plant erection by contractors. It has also been reviewed in the light of modern practice. Copies, price 4s 6d, are obtainable from the IEE, or the other two professional bodies mentioned above.

Plant for Loch Ericht

THE North of Scotland Hydro-Electric Board have placed contracts for a power station on the eastern shore of Loch Ericht, some 10 miles south of Dalwhinnie. A 2,200 kW turbo-induction generator is to be installed, the contractors being Bruce Peebles and Co., with the turbine manufactured by the Armfield Hydraulic Engineering Co. Ltd. as sub-contractors. The power station will work on a maximum head of 196 ft, fed by an existing tunnel from Loch Garry, and will produce 10·3 million units a year.

More Imported Appliances

THREE senior members of the staff of Armorduct Cable Co. Ltd., Mr Denis S. Dow, Mr E. G. Glover and Mr A. R. Lockey, are directors of a newly formed concern, Armorduct Trading Co. Ltd., with an initial capital of £1,000. The company is to distribute foreign domestic appliances, and as a first step is handling a three-heat boiling ring from Belgium.

Approvals Director Wanted

A FULL-TIME Director is now being sought for the Provisional Approvals Board for Domestic Electric Appliances, the establishment of which we reported on 3 Dec. last. A salary of not less than £3,000 p.a. is being offered for a suitable applicant not more than 50 years old (see our classified advertisement pages). The new board will undertake the approval on a National basis of all domestic electrical appliances.

Y.E.B. Display Contest Winners

HALIFAX and Goldthorpe service centres were the winners in classes A and B of the annual Christmas window display competition organised by the Yorkshire Electricity Board. Runners-up were Castleford and Heckmondwike. Gainsborough service centre was specially commended for an effective display in very limited space.

Local judging panels in the sub-areas selected the best displays so that every sub-area entered a service centre in each class for the area competition. Judges in the finals were Mr A. Haselhurst, chief commercial officer of the YEB, and Mr S. Agnew Mercer, managing director of Tattersall Advertising Ltd., Harrogate. The quality of displays showed a marked improvement on preceding years, the judges reported, and had achieved some "remarkable results."

A gay fairground theme featuring cookers and appliances forms the basis of this prize-winning window display staged by the Halifax service centre of the YEB, adjudged best in the Class A section covering premises with a frontage in excess of 20 ft. The contest was the board's annual Christmas window display competition

New Light on Zebra Crossings

ZEBRA crossings in badly lit roads are to be fitted with supplementary lamps to spotlight pedestrians waiting to cross. A new regulation made by Mr Ernest Marples, Minister of Transport, requires local authorities to attach an electric light to the zebra pole just beneath the globe where visibility of pedestrians about to use the crossing after dark needs to be improved. Only the pavement and the first few feet of the crossing will be illuminated.

The supplementary lighting is not to be regarded as a substitute for improved street lighting, the Ministry points out. The regulation comes into force in England and Wales on 19 Jan. Cost of installing and maintaining the additional lamps will rank for Government grant.

Esso push Home Heat plan

FULL-PAGE hard selling advertisements in the Press are being used to promote Esso's new "Home Heat" plan, which features no deposit, low interest, and up to five years to pay. The credit terms are arranged in conjunction with Lombard Banking Ltd., with free life insurance to cover the loan. A complete oil-fired heating system can be installed for as little as 24s a week, the advertisements claim, and those interested are asked to fill in a coupon and post it for full details.

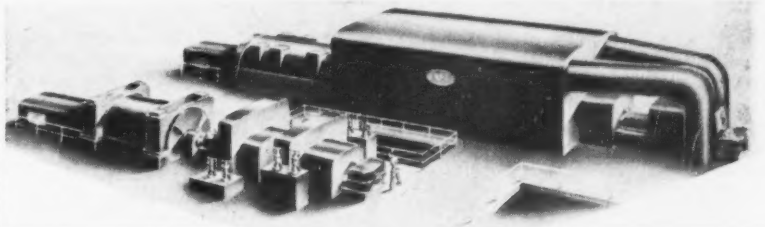
ALL ABOUT WHOLESALERS

WHO is he? What is he? What does he do? These questions are posed on the cover of a 12-page booklet entitled "The Electrical Wholesaler," published last week by the Electrical Wholesalers Federation. Amusingly illustrated by David Langdon cartoons, the booklet explains the functions of the electrical wholesaler, and defines him as being in the right place with the right goods in the right quantities at the right time at the right price.

The booklet is being widely distributed among industry, MPs, the Press, the National Boards, and to the trade through members of EWF.

SECOND 550 MW SET ORDERED

This turbo-generating set is to be built by AEI for the CEGB Thorpe Marsh power station, now under construction near Doncaster. Design and construction will be carried out at the Trafford Park works of the AEI Turbo-generator Division



AEI are to supply the second 550 MW set for the CEGB Thorpe Marsh station. The set will differ from the first (ordered from C. A. Parsons) by having one of its two cross-compounded lines running at 1,500 r.p.m., the other at 3,000 r.p.m. All the l.p. cylinders are on the 1,500 r.p.m. line. The Parsons machine was arranged in line-ahead, while for the AEI design, the two machines are side by side. TSV conditions are 2,300 lb/sq in. 1,050° F, with expansion then through an h.p. cylinder before reheating to 1,050°F for expansion through a first i.p. cylinder on the same 3,000 r.p.m. line. The steam then passes to the low-speed line, where it expands through twin second single-flow i.p. cylinders and twin double-flow l.p. cylinders, and is exhausted to the condensers. Because of the different speeds, the two generators although of equal output will differ in size. Value of the order is put at £3¼ million.

Electricity aids Heat Research

ELECTRICAL appliances and equipment have been installed in a "hot room" at the Liverpool School of Tropical Medicine to simulate, for the purposes of medical research, the conditions of heat and humidity encountered in the tropics.

The room, which has insulated walls, is warmed by domestic convector heaters, the air being circulated by an electric fan and changed three times an hour. The required level of humidity is provided by steam produced by an electric immersion heater. An electrically driven continuous belt acts as a "treadmill" enabling a subject to walk (and thus work) for hours under the kind of conditions found in certain equatorial zones.

The hot room, which cost about £1,000 to build and install, will enable doctors and researchers at the school to investigate problems associated with heat illness, a condition common to many occupations (even in temperate climates), and recognised as an economic hazard in certain industries.

Science Films Plea

SUGGESTIONS for scientific films suitable for a series of programmes to be screened at the annual meeting of the British Association for the Advancement of Science, to be held at Cardiff from 31 Aug. to 7 Sept., 1960, are asked for by the association.

Information submitted should include the title, whether silent or sound, whether black and white or coloured, running time in minutes, address of sponsor, producer and distributor, short synopsis of content and indication of type of audience for which the film is intended.

Details of films should be sent to the Visual Aids Officer, British Association for the Advancement of Science, 18 Adam Street, W.C.2.

£22 washing machine was not for sale

A WASHING machine priced at only £22, widely advertised on television and in the newspapers, was not in fact for sale, it was stated in evidence at Middlesbrough Quarter Sessions last week. "It was just a way of getting into people's houses. The idea was to sell them a more expensive machine."

M. W. Allick (32), a salesman formerly employed by the Nortic Electric Co. Ltd., Marton Road, Middlesbrough, was found not guilty after a three-day hearing on four charges of embezzlement involving a total of £82, two charges of stealing washing machines, and one of obtaining £3 5s by false pretences.

It was alleged that he kept money paid to him by customers for machines. Denying all charges, Allick claimed he handed in all money from customers to the branch manager, but alleged it was used for differing purposes. If Nortic had not been taken over by another concern, he stated, none of its salesmen would have been in trouble, because the old system of paying in money, complicated but honest, would have applied.

A defence witness told the court that salesmen sometimes signed hire purchase agreements themselves to get commission. The branch manager often lent them money to make up part-deposits to the full amount, again to get commission.

More Berry's Expansion

A NEW factory at Bletchley, has just been put into operation by Berry's Electric Ltd. and will be in full production next month. Designed on modern lines, and capable of 300% expansion, the factory will be administered by the Magicoal works at Wembley. Replacing an earlier project, planned for Bicester, the new source of production will enable the company to reduce its backlog of orders and give improved deliveries.

Divisional Controller warns Canterbury Farmers of Winter Power Troubles

SERIOUS difficulties in East Kent's power supply may arise next winter because opposition to the Northfleet-Canterbury-Lydd supergrid line scheme had delayed progress by a year, Mr W. H. Dunkley, divisional controller of the SE Division of the CEGB, told the Canterbury branch of the National Farmers' Union at a meeting last week.

"It is highly improbable that the new 275 kV supply system will reach Canterbury before March, 1961," he said. "If, due to gales, snow and very cold weather, the electricity load is at a maximum when one of the power lines collapses, we don't know what will happen. There might also be trouble this winter."

The CEGB had spent some £30,000 last year to make the best use of the East Kent Grid. The board worked to a well-conceived plan. Their general principle in deciding where power lines had to go was to draw a straight line between points, but sometimes a straight line was impracticable, and divergencies were invariably made for some reason which could not be overcome.

Mr Dunkley pointed out that the approved route of the Northfleet-Canterbury lines, agreed after two years, was in fact the same one as the board originally drew up three years ago. They had even engaged the services of a lady landscape artist to approve the position of the pylons and farmers' sons and men of the land had been recruited by the board as wayleave wardens to watch the work on the pylons in the farmers' interests.

"But I won't be happy until the last week of February," he added, referring to winter power hazards. "In the winter of 1960-61 we will be lucky if there are no power failures in East Kent."

European Purchasing Conference

THE second conference of the European Federation of Purchasing will be held in Scheveningen, Holland, from 21 to 23 April, 1960.

The sessions include: *Common Problems of Buyers in Europe*, by M Paul Gros, purchasing director, French National Railways, and president of the Federation; *Organisation of the Purchasing Department—Selection and Training of Personnel*, by J. Murray Grammer, director-general of purchasing and stores, National Coal Board; *Relations between the Purchasing Department and Other Departments*, by Reg. Rat. a D. Hanns Rump (president of BIE); *Terms of Purchasing*, by T. Beil, purchasing officer, Union Co., Oslo. There will also be a series of syndicate discussions.

The conference fee will be N.f.50. Full details are available from the secretary, Purchasing Officers' Association, Wardrobe Court, 146a Queen Victoria St, E.C.4.

MORE H.P. IN NOVEMBER

HIRE-PURCHASE debt owed to household goods shops and finance houses in November last year totalled £525 million, an increase of £24 million on the previous month and nearly 60% up on November, 1958. The proportion due to household goods rose by £12 million to £205 million, a slightly higher and seasonable increase, as compared with an average monthly gain of £10 million from August to October.

ETHER REORGANISE

FOLLOWING the acquisition of the J. Langham Thompson group, Ether Ltd. have now changed their name to Ether Langham Thompson Ltd. Mr J. Langham Thompson and Rear-Admiral Sir Philip Clarke have joined the board. At the same time a new company, Ether Ltd., has been formed as a wholly owned subsidiary to carry on the firm's business.

The group, which is engaged in industrial instrumentation and control systems, electro-mechanical engineering, etc., now consists of Ether Langham Thompson, Ltd., as parent company, owning the entire issued share capital of Ether Ltd., Electro Methods Ltd., and J. Langham Thompson Group Ltd.

On the Appliance Wagon

JOHN HARPER AND CO. LTD., of Willenhall, the castings and domestic ironmongery firm, are entering the electrical domestic appliance field for the first time. They are to market a 2½ cu ft absorption type refrigerator priced at £47 15s 6d retail, under their name of Harper. This is the result of an agreement with Hermann Forster, of Arbon, Switzerland, giving them the sole selling right and option to manufacture the refrigerator in the UK.

Swiss Display at Physical Society Exhibition

SWISS instruments will be on view this year at the 44th exhibition of the Physical Society to be held at the Horticultural Society's New and Old Halls, Westminster, from 18 to 22 January. This special display, by invitation of the Council, is arranged under the auspices of the Swiss Physical Society and the Swiss Office for the Development of Trade. The exhibition will be opened on 18 January by the Physical Society's president, Mr J. A. Ratcliffe, C.B.E., M.A., F.R.S.

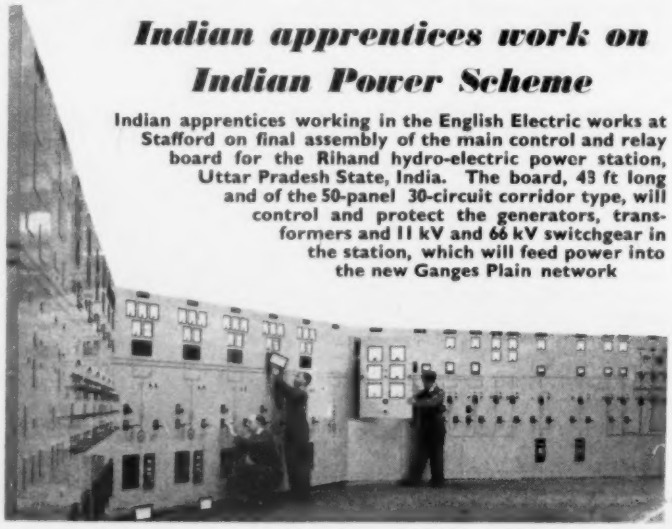
As on previous occasions, there will be many new instruments and devices on show, as well as a number of old friends brought up to date, as, for example, a planimeter with digital presentation. Recent progress in the semi-conductor field will be indicated by demonstrations of the latest zone refining techniques, and also by magneto-sensitive elements based on the Hall effect. There will, in addition, be an exhibit of thermocouples designed to operate at temperatures of up to 2,800° C.

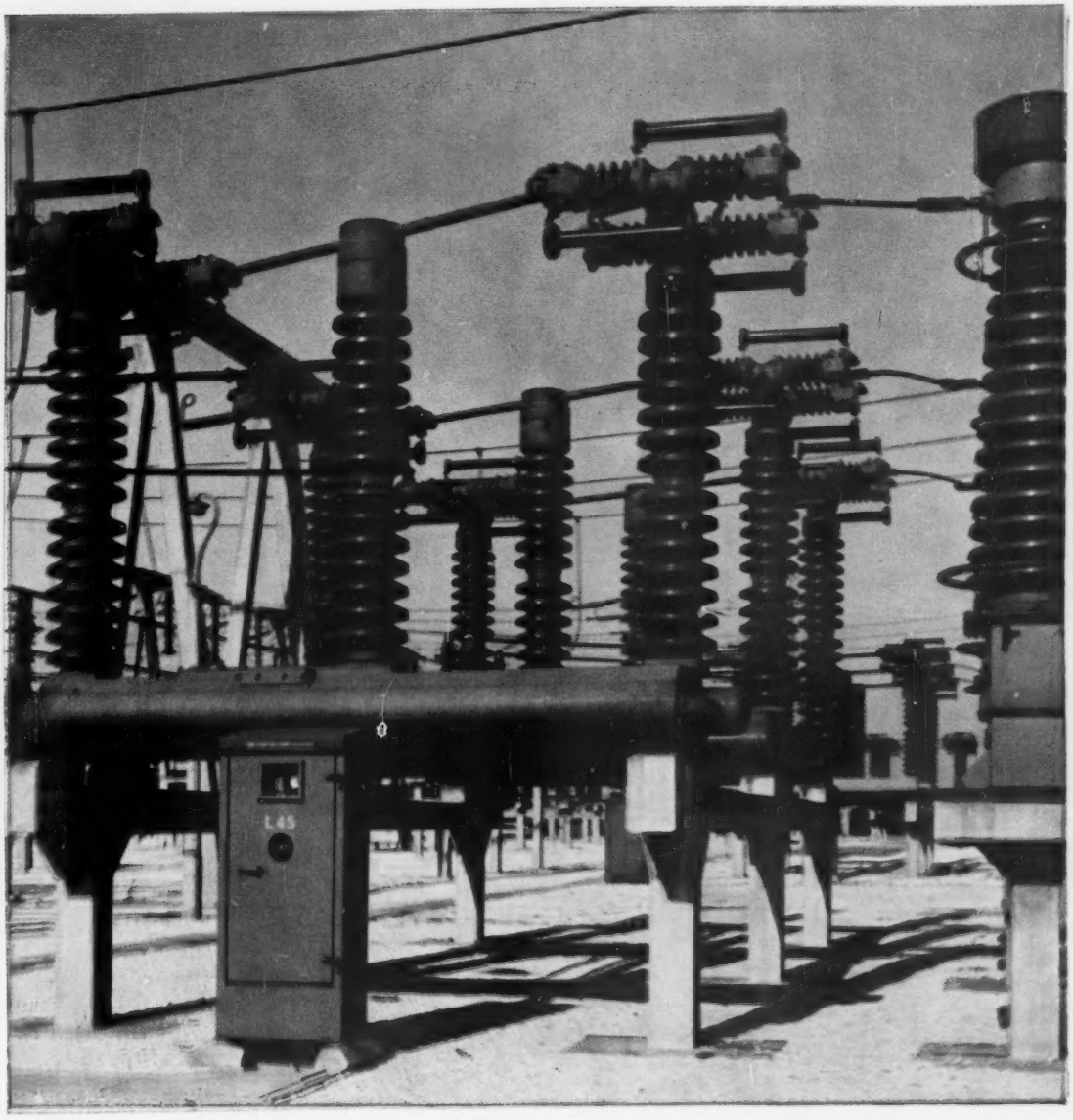
A feature of the exhibition will be a series of lectures on the reaction of the human body to the stresses of high performance flight, by Fl-Lt J. Billingham; on atomic time, by Dr Essen of the NPL; and on recent advances in solid state physics, by Dr D. A. Wright.

A full report of the exhibits will appear in our issue of 28 January. The exhibition will be open each day from 10 a.m. to 7 p.m. except Tuesday, when the closing time will be extended to 9 p.m., and Friday, when the exhibition ends at 1 p.m. Admission is by ticket only, obtainable by application in writing from the exhibition secretary, 1 Lowther Gdns, Prince Consort Rd, S.W.1.

Indian apprentices work on Indian Power Scheme

Indian apprentices working in the English Electric works at Stafford on final assembly of the main control and relay board for the Rihand hydro-electric power station, Uttar Pradesh State, India. The board, 43 ft long and of the 50-panel 30-circuit corridor type, will control and protect the generators, transformers and 11 kV and 66 kV switchgear in the station, which will feed power into the new Ganges Plain network



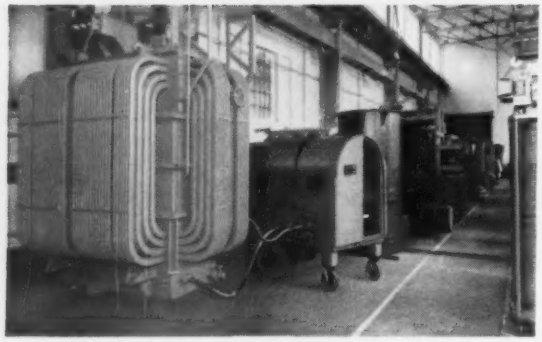


TRAWSFYNYDD—Britain's latest nuclear power station, in North Wales, will incorporate a twelve-switch, double-busbar switching station, equipped with 275 kV, 7,500 MVA air-blast circuit-breakers, similar to those illustrated. They will be made at the Trafford Park Works of A.E.I. Switchgear Division.

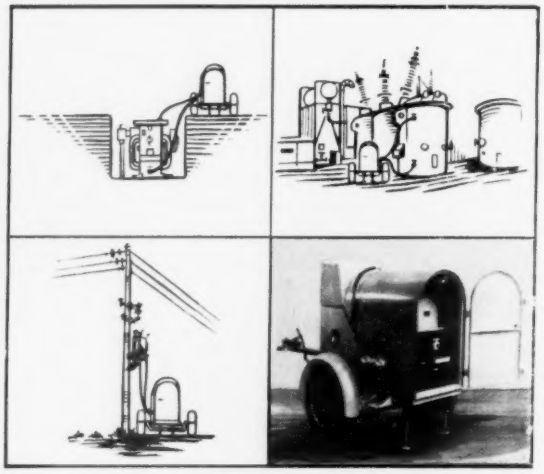
Associated Electrical Industries Limited
SWITCHGEAR DIVISION
Trafford Park, Manchester • Higher Openshaw, Manchester • Willesden, London

F/A 908

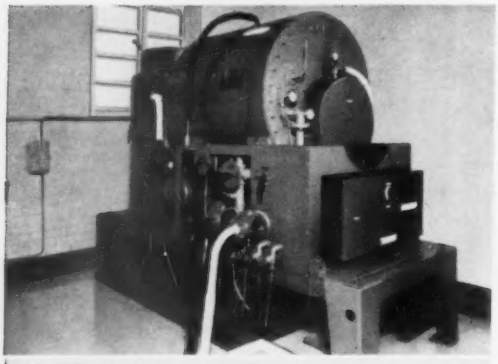
STREAM-LINE FILTERS ensure a dielectric strength far above that specified for new insulating oil

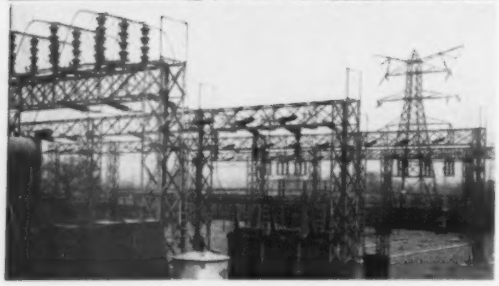


At transformer manufacturers' works



At sites above, below and at ground level



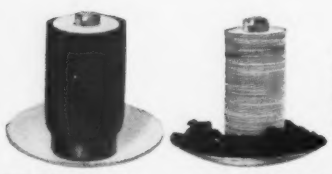


At electrical installations

The Stream-Line filter, embodying filtering elements, heating chamber and vacuum receiver, is the most perfect practical method of removing all traces of solid matter, water vapour and gases from insulating oil. The filter elements are built up of special paper discs under maintained end-compression so that even the finest impurities are held back at the paper edges.

The well-known "CN" (Medium Vacuum) types for servicing insulating oil in transformers and switchgear employ a vacuum of 28″/29″ Hg. The "CN-HV" (High Vacuum) range for servicing equipment in the manufacturers' works operates at pressures in the order of 0.1 mm. Hg.

Many applications of interest to all electrical plant manufacturers and supply undertakings are fully described with relevant technical data in a 16-page booklet available on request. Please write for Catalogue W.1031.



Solid impurities in the oil are deposited in their entirety at the paper edges. Cleaning is effected simply by a reverse flow of compressed air.

STREAM-LINE FILTERS LTD • HENLEY PARK • NORMANDY • NR. GUILDFORD • SURREY

Telephones: Normandy 3311-3

Telegrams: Edgefilt, Guildford.

A member of the VOKES Group with world-wide representation

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Hoover and "Our Man in Havana"

A MAKE-BELIEVE "Atomic Pile" vacuum cleaner, specially designed and built by Hoover, was featured in the Columbia film *Our Man in Havana*, in which the hero is a vacuum cleaner salesman. Now Hoover are to combine with Columbia Pictures in a joint sales promotion campaign which will include distributors and dealers at home and abroad.

Hoovers make-believe "Atomic Pile" vacuum cleaner for the film "Our Man in Havana"

Plans include a £5,000 contest, with a holiday for two in Havana (or £1,000 in lieu) as first prize, plus hundreds of Hoover products for other prizes. The campaign will be supported by advertising, exhibitions and displays, in which Hoover dealers will co-operate.

Duty on Mica Sheets

THE Board of Trade announce that, after due consideration, they have decided to reject an application for the removal of import duty on sheets made wholly from disintegrated mica.

Focus on Welding

A "FOCUS on Welding" exhibition, organised by the Electronic Engineering Association in conjunction with MANWEB, will be held at MANWEB's Electricity Industrial Development Centre, 83 Paradise St, Liverpool 1, from 20 to 22 Jan. The exhibition will include demonstration of modern arc welding techniques, electrodes and equipment for use on a.c. and d.c.

Sayings OF THE WEEK

"The board have long realised that gas-heated laundry appliances have not the same consumer appeal as their electrical counterparts." . . . MR D. K. WARD, chairman, Burco Dean Ltd.

"Protection gear may be expensive, but it is a sight cheaper than duplicate circuits." . . . MR H. G. BELL, in the second IEE Hunter Memorial lecture.

"If a new hall were a venture which could stand on its own feet and show a profit, then I firmly believe someone would have done it by now." . . . MR R. E. BEARDMAN, at Design and Industry Association's discussion on a new exhibition hall.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, January 12

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	257½	+2½
,, (3 months)	246½	+4½
LEAD, refined pig, 99·97% purity (cash)	75½	+⅛
,, (3 months)	75¼	+1
TIN, refined, min. 99·75% purity (settlement)	790	−1
(3 months)	787	+1
ALUMINIUM, ingots 99·99·5% ...	186	—
,, wire bars 99% purity	209	—
BRASS Strip 63/37	220½	—
SILVER (Troy oz)	80¼d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	95½	+½
,, (3 months)	92½	+1½
RUBBER, per lb.		
No. 1, R.S.S. spot	35d	+⅛d
c.i.f. basis, ports. Mar.	33⅛d	−⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 × 1½ in.)	47/14s	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	71½	—
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	35c	—
Lead (New York)	12c	—

"Which" looks at Heating Costs

CONSUMERS ASSOCIATION LTD., publishers of *Which*, are to attempt to work out what are the heating methods best suited to the various houses, conditions and people in the UK. This is stated in the current issue of *Which*, and as a start a guide is offered to comparative running costs of heating with electricity, gas, oil and solid fuel.

The results are expressed in "cost per useful therm," the product of cost of fuel, its calorific value, and appliance efficiency, and listed against types of appliance. The assumed price of fuel is given, but values assumed for the other factors are not stated. Considering heaters giving mainly radiation for room heating, the costs range from an openable stove run with coke at 190s/ton, which is said to give heat at 1s 5d/useful therm, to an electric radiant fire as the top price, at 3s/useful therm for a price of 1¼d/unit.

The traditional open fire with coal at 185s/ton is listed as costing 2s 8d/useful therm, and a radiant-type gas fire as 2s 10d/useful therm. Other tables are given for "heaters giving mainly convection for background heating" and "central-heating systems." In the last category, no electrical representative is included.

Also included in the survey are brief comparisons of gas and electricity for cooking and water heating. It is suggested that with gas costing less than 2s 2d/therm, it should be cheaper than electricity at 1¼d/unit for water heating, while for cooking, the break-even point is 1s 10½d/therm. But the survey ends with a warning that no one fuel is best or cheapest in all circumstances.

The January number of *Which* also includes a survey of sunlamps, covering ten models, "not recommending" one, and suggesting a "best buy."

Floor-warming for Curing Concrete

A NEW application of floor warming is being carried out for Marley Concrete Ltd. in connection with the manufacture of concrete beams. This firm have always experienced difficulty in obtaining continuous output during the winter due to the fact that it is necessary to stop manufacture when the temperature is lower than 34° F. The Eastern Electricity Board have installed Pyrotenax heating cables with a loading of 5 kW and 3 kW in two plinths on which the concrete beams are made.

It is expected that by means of thermostatic control it will not only be possible to afford ample frost protection but also to increase the curing rate of the concrete.

B.E.A.M.A. at Cologne

TEN BEAMA firms are to exhibit British domestic electrical appliances at the Cologne Hardware Fair from 11 to 14 March. Arrangements for the display, which were made by BEAMA in conjunction with the BoT, include an information bureau with multi-lingual interpreters.

The firms exhibiting are: Columbus-Dixon, Corfield-Sigg, Dimplex, Electrix, English Electric, Hoover, Radiation, Remploy, Revo Electric, Simplex Electric.

News in Brief

AEI Heavy Plant Division, Rugby, have obtained orders worth nearly £700,000 from Australian Industries Pty. Ltd., for electrical equipment for rolling mills.

Luxram Electric Ltd. have been awarded the British Standard Licence No. 3189 in respect of their lamps. They claim to be the only non-ELIC concern to hold such a licence.

Closing date for registrations for the BEAMA Domestic Appliance Division's export sales conference is 16 Jan., not 10 Jan. as we stated last week.

Scottish Division, NCB have ordered a three-level shaft signalling indicator system from Heyes and Co. Ltd.

Philips electro-acoustical equipment has been installed in the new NATO headquarters in Paris, inaugurated this month.

Company Activities

SOME of the froth had to go. After a year's dizzy ascent, share values had taken on a decidedly "toppy" look and had evoked on more than one occasion warnings from the Throgmorton Street soothsayers. The watched-for break in Stock Markets duly arrived last week. But the event proved a very gentle setback, no more than a salutary pause. Signs of recovery were not entirely absent and, indeed, point to the fundamental firmness in share affairs.

None the less, electrical issues appeared somewhat run down with AEI, BICC and GEC all a shilling or two below their recent best while Thorn Electrical Industries dropped from 55s 6d to 52s despite figures showing that deliveries of electric lamps rose again in October to a total of £2,121,000 against £2,064,000 in the corresponding month of 1958. Crompton Parkinson, Reyrolle and C. A. Parsons among the heavier electricals were also inclined easier although I see these three mentioned favourably by a leading firm of London stockbrokers. In fact, electrical investors, as a group, would appear assured of sound nights. Tables published last week on page 30 of THE ELECTRICAL TIMES indicate just how much UK ownership of refrigerators and washing machines has to catch up with similar ownership in the Free World's major economies. The latest production, delivery and sales figures for machine tools, radios, TV sets, electric cookers, refrigerators and washing machines all confirm the industry's basic growth curve so that short-term price oscillations about the trend in electrical shares will hold no fear for the longer term investor.

There was sturdy news from International Computers and Tabulators, where Sir Cecil Weir is chief programmer. Reporting to shareholders of the British Tabulating-Powers-Samas merger group now popularised as "ICT," he points out that the year's maintained 10% dividend, which the results of merger operations justify, is payable on a capital increased (by the December, 1958, one-for-four free scrip and the "merger" issue) from £4 million to £8,055,000. And still earnings, complicated by merger costs and the 12 months' accounting figures for British Tabulating against only nine months for Powers, would appear to cover the 10% dividend at least twice. Even so, the group's £1 Ordinary shares came back 1s 3d on the balance sheet to 76s 3d.

Sir Cecil Weir is also abundantly optimistic about ICT's future despite the intense competition that must now be developing from EMI, Ferranti, IBM and Elliott-Automation. Among the largest producers in Europe, ICT's electronic calculators attract favourable opinion both in home and overseas markets and over 1,000 of these machines are now installed while there are substantial orders in hand. He also announces that ICT are about to place a new series of computers on the market, and speaks mysteriously of "certain further developments of a novel character which are now in the design stage."

It can be taken that whatever they are they will add rather than subtract value to the Equity by the time Sir Cecil's next set of accounts appear.—*From our City Correspondent.*

Burco Dean Ltd.

A development programme for new products for the Electrical Division has been pursued with vigour over the last few years. Details of a new combination washing machine and spinner are to be revealed next week. This is to be backed by a strong advertising campaign in March, Mr D. K. Ward, the chairman, states. The planned reorganisation of production has been taken a step further with the acquisition of Peel Mill, Accrington, to where the manufacture of washboilers has been transferred. That factory now houses the businesses of Panette Holloware Ltd., Amplec Ltd. and Henry Slack and Sons Ltd., which have been incorporated into one unit. This move has enabled Burco at Burnley to expand its range of products where physical limitations had prevented further expansion. Another building has also been purchased to house the aluminium die casting and zinc base die casting factory and leave room for expansion. These changes have released for sale or alternative use six small factories. Three have since been sold, one part rented and two remain to be sold. To fulfil the second stage of expansion, a 18½-acre site near the Burnley factory has been bought and, as we have already reported, the Board of Trade are to erect a 12,000 ft factory for the company. This is expected to be completed next year. The board considers that present capital needs can be financed by the bankers and from the company's resources. Before any further capital is sought a revaluation of properties is to be carried out. Mr Ward emphasises that these factors of removal and heavy advertising expenses have influenced the board against any substantial increase in dividend for the current year despite the large increase in net profits. He warns that the profits for 1960 will be substantially reduced.

Year to 30 Sept.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1955	525,442	221,771	75	22½	17/3	11/9
1956	353,422	127,166	42	20	13/4	8/–
1957	529,600	205,105	68	22½	9/7	5/10½
1958	494,657	193,311	43	16*	12/9	7/6
1959	586,991	257,347	54	18	20/3	12/1

* Plus 50% capital bonus

Dewhurst and Partner

To meet intensive competition prices of some lines of equipment produced were reduced, whilst simultaneously increased costs were absorbed, Mr M. Dewhurst, the chairman, reports. That obviously accounts for the lower profit figures last year. But output is being maintained, with the order book showing signs of improvement and he is hopeful that this trend will continue, although he cannot see a return to the very favourable trading conditions which existed for some years. Output potential of the works is greater than it has ever been, with the extension to the Amersham premises completed and improvements made at Hounslow. Efforts are being made jointly with Canadian colleagues in Dupar (Canada) Ltd., to increase the distribution of products there.

Year to 30 Sept.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1955	241,985	106,984	103	30	12/3	7/4
1956	288,791	124,759	60	16½*	7/6	5/2
1957	346,249	149,359	72	20	7/11	5/9
1958	317,846	133,978	65	20	9/6	6/10
1959	240,001	107,510	49	20	9/6	7/1

*Plus 100% capital bonus.

Lloyd's Packing Warehouses (Holdings)

Among this concern's subsidiaries is the Regentone radio and t.v. company which had its highest ever turnover and profits in the year ended 30 Sept. last, Sir Eric Carpenter, the chairman, states. But he warns that there are signs that the market peak has been reached, making it reasonably certain the current year will be one of even keener competition.

Marco Refrigerators Ltd.

Group profit, before taxation, for the year to 30 Sept. last dropped to £32,639, from the previous year's figure of £52,277. The board point out that a great deal of the company's activities have been devoted to the design and preparation of a number of new models, for which large sales are expected in the forthcoming season. The total dividend is maintained at 11% with a final of 8½%.

Ultra Electric (Holdings) Ltd.

Full voting rights are to be given to the "A" Ordinary stockholders. The "A" Ordinary stock is to be converted in an equivalent amount of Ordinary, and the existing Ordinary, as compensation, will receive one unit for every 20 held. Trading of the group is to be carried on by two subsidiaries in future (details, page 70).

Intended Dividends

Greenwood and Batley. Interim 10% (*same*).

Morgan Crucible Co. Interim maintained at 5% on capital increased by a two-for-five scrip issue.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

15 Jan.—Edinburgh T.C. Electrical installation in proposed new offices, 20 Cockburn St. Applications to City Architect, City Chmbrs, Edinburgh, by above date.

15 Jan.—Portadown B.C. Supply of lamps (Item 6) for year to 28 Feb., 1961. Borough Surveyor, Tavanagh House, Portadown, Armagh.

16 Jan.—Glasgow T.C. Electrical work at sub-station and two police houses, Hawthorn St, Springburn. Applications to City Architect and Planning Officer, 20 Trongate, Glasgow C.1.

18 Jan.—Beckenham B.C. Jobbing work (electrical trades) for year from 1 April, 1960. Borough Engineer, Town Hall, Beckenham.

18 Jan.—Droxford R.D.C. Installation of immersion heaters and insulation jackets in 680 houses on fixed-price basis by approved contractors.—See 24 Dec. issue.

18 Jan.—Faversham B.C. Supply and erection of 11 140 W sodium discharge lamps and prestressed concrete columns with brackets at Stone St.—See 7 Jan. issue.

18 Jan.—Flintshire C.C. Supply of various types of bulbs (item 25) and (item 27c) batteries.—See 7 Jan. issue.

18 Jan.—Gillingham B.C. Supply of: (item 16) switches and accessories; (17) conduit; (18) wire cables and accessories; (19) lamps for year—See 7 Jan. issue.

18 Jan.—Hayes and Harlington U.D.C. Supply of (item 16) conduit, fittings and accessories; (17) street lighting discharge lamps (item 13) and (14) discharge lamps (19) c.i. and concrete lighting columns; (21) m.v. and l.v. cables; (28) time switches. —See 7 Jan. issue.

18 Jan.—Loughborough B.C. Supply and installation of two centrifugal pumps, each capable of discharging 300 g.p.m. and two a.c. motors with ancillary equipment for Derby Rd industrial site sewage.—See 7 Jan. issue.

18 Jan.—Renfrew C.C. Electrical work in 17 houses in five blocks at Harvey Terr, Lockwinnoch. Applications to County Engineer, 16 Back Sneddon St, Paisley, by above date.

18 Jan.—Southampton T.C. Electrical installation at Glen Eyre Secondary Girls' School. —Advertised 31 Dec. issue.

18 Jan.—Twickenham B.C. Supply of street lighting columns and fittings, cables, conduit and lamps.—See 7 Jan. issue.

18 Jan.—Westminster T.C. Supply of lamps for year commencing 1 April, 1960.—See 24 Dec. issue.

18 Jan.—West Riding C.C. Renewal of electrical mains and extension of electric heating system at Brook Lodge, Selby, for Health Committee. Apply to County Architect, Bishopgarth, Westfield Rd, Wakefield, by above date.

19 Jan.—Cardiff T.C. Electrical installation in Borderline E.S.N. School, Llanishen. City Surveyor, City Hall, Cardiff. Deposit £2 2s.

19 Jan.—Kingston upon Thames B.C. (c) Wiring for lighting of 58 market stalls. —See 31 Dec. issue.

19 Jan.—Londonderry C.C. Electrical, heating and plumbing installations in primary school extension.—See 24 Dec. issue.

20 Jan.—Ballymoney. Improvements to electrical distribution system at Route Hospital. Consulting engineers: W. and M. Given, 1 Waterside, Coleraine. Deposit £3 3s.

20 Jan.—Carlisle T.C. Erection of 120 Group "B" street lighting units with either mercury or sodium lighting.—See 7 Jan. issue.

20 Jan.—Feltham U.D.C. Supply of lamps, item 4 on supplies list for year commencing 1 April.—See 7 Jan. issue.

20 Jan.—Worthing B.C. Supply tungsten lamps (item 13) and (14) discharge lamps for year to 31 March, 1961.—See 7 Jan. issue.

21 Jan.—Newcastle-on-Tyne T.C. Supply and installation of two automatic passenger lifts in each of six 15-storey blocks of flats at Pottery Bank, Westgate Rd and Church St, Walker.—See 17 Dec. issue. Supply and installation of lightning protection equipment in six blocks of flats from 12 to 15 storeys high at Heaton Pk Rd, Cruddas Pk and Shieldfield.—See 31 Dec. issue.

22 Jan.—Aberdare U.D.C. Supply of, item 14, lamps for year to 31 March, 1961.—See 7 Jan. issue.

22 Jan.—Belfast T.C. Supply of: (1) turbine oil; (2) transformer oil; (3) fireclay, etc.; (5) carbon brushes; (6) steel wire rope; (8) glazed stoneware ducts; (9) distribution and street lighting pillars; (10) 6·6 kV indoor metalclad switchgear; (11) meters, instrument transformers, etc.; (12) m.d. indicators; (13) time switches; (14) l.t. fuse units, etc.; (15) transformers; (18) washboilers; (19) kettles; (21) cookers.—Advertised 31 Dec. issue.

22 Jan.—Norwich T.C. (1) Supply of 62 200 W, 39 140 W medium angle and 20 140 W cut-off type SO/H lanterns; (2) supply of control gear and lamps; (3) supply of 121 tubular steel columns; and (4) erection and part connection for (a) A11 Newmarket Rd, (b) Thorpe Rd and main traffic route and (c) Harvey La.—Advertised 7 Jan. issue.

23 Jan.—Camborne-Redruth U.D.C. Supply of electrical equipment and fittings, item 24, on list for year ending 31 March, 1961.—See 10 Dec. issue.

23 Jan.—Cardiff. Supply of cables, conduit and conduit fittings to Hospital Management Committee for year from 1 April, 1960. Supplies Officer, Cardiff H.M.C., Lansdowne Hospital, Canton, Cardiff.

23 Jan.—Montgomeryshire C.C. Electrical installations in seven holdings, Pool Rd, Newtown. County Land Agent: D. A. Cresswell, Welshpool.

23 Jan.—Newcastle-on-Tyne T.C. (b) Electrical and (c) lift installation in new Town Hall. Applications to City Architect, 18 Cloth Market, Newcastle-on-Tyne 1, by above date.

23 Jan.—Nottingham T.C. Supply of, item 2, lamps for E.C. Director of Education, W. G. Jackson, Exchange Bldgs, Nottingham.

23 Jan.— Swansea T.C. Supply of lamps, cables, public lighting equipment, concrete and steel columns for supplies list.—Advertised 31 Dec. issue.

25 Jan.—Glamorgan C.C. Supply, erection and putting into service of eight 140 W sodium lighting units on A48 roundabout at Culverhouse Cross. County Surveyor and Planning Officer, County Hall, Cardiff.

25 Jan.—Huddersfield T.C. Supply of (item 17) tungsten lamps; (18) m.v. and sodium lamps; (19) cables. Borough Engineer and Surveyor, High St Bldgs, Huddersfield.

25 Jan.—Manchester T.C. Installation of 6·6 kV cables, road lighting and telephone cables at Davyhulme Sewage Wks extensions, stage 1B.—Advertised 7 Jan. issue.

25 Jan.—Manchester T.C. Electrical installations in 48 dwellings at Levenshulme (Contract 265) and two surgeries, Ridgway St (Contract 222F). Director of Housing, Town Hall, Manchester 2.—Advertised in this issue.

25 Jan.—Manchester T.C. Supply of (Schedule A) carbon brushes, etc., o/h equipment. Manager, Corporation Transport Dept., 55 Piccadilly, Manchester 1.

25 Jan.—Staffordshire C.C. Provision of linear sodium street lighting on A5, Fazeley Roundabout. County Surveyor, County Bldgs, Stafford.

25 Jan.—Wembley B.C. Supply of lamps, item 9, on supplies list.—See 7 Jan. issue.

26 Jan.—Blackburn T.C. Maintenance of school meals canteen equipment (item 2b) electric and (item 2c) refrigerators for year from 1 April, 1960.—See 7 Jan. issue.

26 Jan.—Egham U.D.C. Supply and erection of 712 Group "B" lanterns, fittings, prestressed concrete and timber columns, brackets, etc. Engineer and Surveyor, 155 High St, Egham. Deposit £2 2s.

28 Jan.—Gainsborough U.D.C. Conversion of hand-operated service lift to electric drive in Town Hall.—See 7 Jan. issue.

28 Jan.—Gt. Yarmouth T.C. Electrical installation in new H.Q., police station at Howard St South.—See 24 Dec. issue.

28 Jan.—Luton B.C. Erection and wiring only of 440 Class "B" concrete lighting columns with sodium discharge lighting. —See 7 Jan. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 106 queries answered this week

"Desco" fuses—makers of? E.E.L.—G. P. Dennis Ltd., Fleming Rd, Speke, Liverpool.

"Stephens" electric hen—makers of? E.E.W.—Stephens Cabinet Incubator Co. Ltd., Hempsted La, Gloucester.

"Beurer" electric blankets — address for? S.E.B.—E. F. Allchin and Co., 253 Bordesley Green, Birmingham 9.

"E.M.B." contactors—makers of? T.E. —E.M.B. Co. Ltd., Moor St, West Bromwich, Staffs.

"Paracam" cables—makers of? C.E.G. —Greengate & Irwell Rubber Co. Ltd., Greengate, Manchester 3.

"Acme" lampholders — address for? G.E.—S.S. Metal Spinners, Hirwaun Industrial Estate, Aberdare, Glam.

"Brandt" refrigerators — agents for? L.E.B.—Layford Electrical Co. Ltd., 7 Chesterfield Gdns, W.1.

Hobourn Domestic Appliances Ltd.— address for? A.K.—Strood, Rochester, Kent.

Portable heaters for washing machines —makers of? D.G.—Eltron (London) Ltd., Strathmore Rd, Croydon, Surrey.

"Stenor" vulcanising unit—makers of? J.L.W.—Stenor Ltd., 37 Kew Foot Rd, Richmond, Surrey.

29 Jan.—Churchdown P.C. (1) Supply of 94 140 W sodium aero-screened lanterns with ancillary equipment; (2) supply and erection of 94 steel columns together with fitting and wiring of tenderer's own lighting equipment; (3) as (2) but for fitting and wiring of equipment offered by another firm.—Advertised 31 Dec. issue.

29 Jan.—Doncaster T.C. Supply of (item 13) lamps for year to 31 March, 1961. Borough Surveyor, 2 Priory Pl, Doncaster.

29 Jan.—Gt. Yarmouth T.C. Supply of cables for year from 1 April, 1960. Borough Engineer, Town Hall, Gt. Yarmouth.—Advertised in this issue.

29 Jan.—Manchester T.C. Contract 324, supply and installation of two passenger lifts in nine-storey block of flats at Kingsgate Rd, Wythenshawe. Director of Housing, (Room 626), Town Hall, Manchester.

29 Jan.—Renfrew C.C. Supply and erection of: (A) sodium vapour lighting with minimum output of 20,000 lumens on 35 ft steel columns with a 9 ft outreach; Stage 1—41 units Glasgow boundary to Eastwood Toll; Stage 2—204 units Eastwood Toll to Malletsheugh Inn. (B) 140 W sodium vapour lighting on 25 ft steel columns with a 4 ft outreach; Stage 1—45 units Rouken Glen Rd, Giffnock and Thornliebank; Stage 2—44 units Speirsbridge Rd, Main St, Thornliebank. District Clerk, 295 Fenwick Rd, Giffnock.

30 Jan.—Bermondsey B.C. Supply of lamps for year from 1 April, 1960. Town Clerk, Municipal Offices, Spa Rd, S.E.16.

30 Jan.—Fife C.C. Supply of 32 steel columns, sodium lanterns, etc., for Group "A" roundabout lighting. County Surveyor, "Belfield," Cupar.

30 Jan.—Gloucestershire C.C. Supply of lamps for year from 1 April, 1960, to Welfare Committee. County Welfare Officer, 2 College St, Gloucester.

30 Jan.—Horbury U.D.C. Supply of (item 2) 240 V street lighting lamps for year to 31 March, 1961. Engineer and Surveyor, Town Hall, Horbury.

30 Jan.—Runcorn U.D.C. Supply of (item 15) lamps for year to 31 March, 1961. Clerk of the Council, T. J. Lewis, Town Hall, Runcorn.

30 Jan.—Stockport T.C. Supply of street lighting equipment (item 13) lamps; (14) lanterns, chokes, capacitors and time switches. Borough Surveyor, Town Hall, Stockport

1 Feb.—Chester T.C. Supply of bulbs for year to 1 April, 1961. Town Clerk, G. Burkinshaw, Town Hall, Chester.

1 Feb.—Glastonbury B.C. Supply and erection of pumps, motors, control gear, pipework and valves at Wells Rd sewage pumping station. Borough Engineer and Surveyor, High St, Glastonbury.

1 Feb.—N. Ireland. Electrical installation in new office building, Queen Elizabeth Rd, Enniskillen. Room 103, Law Courts Bldg, Belfast 1.

3 Feb.—Friern Barnet U.D.C. Supply of street lamps for year from 1 April, 1960. Engineer and Surveyor, Town Hall, N.11. Advertised in this issue.

3 Feb.—Machrihanish. Electrical work in connection with runway extension, etc., including: (a) lighting installation including runway and approach systems; (b) h.v. and m.v. cable installations extensions, (c) connecting of cables, switchgear, transformers, etc., in substations and lighting in substations and control building. N.A.T.O. Common Infrastructure Contract Slices VII and VIII, value £105,000.—See 7 Jan. issue.

3 Feb.—Southwark B.C. Supply of (item 8) lamps. Town Hall, Walworth Rd, S.E.17.

5 Feb.—Brentwood U.D.C. Supply of (item 22) bulbs for year to 31 March, 1961. Engineer and Surveyor, Council Offices, Brentwood.

6 Feb.—Barry B.C. Supply of (I) electrical goods including vehicle batteries for year from 1 April, 1960. Borough Engineer, John Proctor, Town Hall, Barry.

6 Feb.—Newbury B.C. Supply and installation of three vertical spindle suspended axial flow propeller pumps each capable of 2,014 g.p.m. for sewage effluent pumping station. Borough Surveyor, Municipal Bldgs, Newbury. Advertised in this issue.

8 Feb.—Brighouse B.C. Supply of mercury discharge and tungsten lamps. Borough Engineer, Commercial St, Brighouse.

8 Feb.—Kirkcaldy T.C. Supply and installation of 300 cookers and 300 washboilers. Burgh Engineer, Town Hse, Kirkcaldy.

8 Feb.—N. Ireland. Main connections between generator and associated transformer for No. 3 60 MW turbo-generator at Coolkeeragh. Details from consulting engineers, Kennedy and Donkin, 64 Royal Exchange, Manchester 2. Deposit £5 5s.

10 Feb.—Lancaster T.C. Supply and installation of: (1) three low lift pumps (two of which working together to deal with 3,050 g.p.m. and 4,500 g.p.m.); (2) three high lift pumps (two of which for 2,778 and 4,167 g.p.m.), for River Lune Scheme. Advertised 7 Jan. issue.

13 Feb.—Grimsby B.C. (c) Electrical installations, on fixed-price basis, in remodelling of Edward Primary Infants' School, Edward St. Borough Engineer and Architect, Municipal Offices, Town Hall Sq, Grimsby. Deposit £5.

No date stated—Calne B.C. Installation of immersion heaters together with ancillary wiring in 250 dwellings.—See 7 Jan. issue.

No date stated—Hertfordshire C.C. Applications invited for inclusion on list for electrical work.—See 7 Jan. issue.

No date stated—Swinton B.C. Electrical installation in 16 flats. Borough Engineer, Town Hall, Swinton.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

16 Feb.—India. Three 4,500 h.p. horizontal Francis turbines complete with step-up transformers, switchgear for Trisuli hydro-electric project, Nepal. Coordination Branch, India Store Dept., Bromyard Ave, W.3. Fee £4 10s. Tender inquiry: PROJECT/SE/4241K/1, which can be inspected reference: S.3911/59/NSC/ENG.2.

11 March.—New Zealand. Electrical equipment for 400-450 h.p. diesel-electric shunting locomotives to be built locally. Chief Purchasing Officer, New Zealand Government Office (Ref. C/F.99/2783), Adelphi Bldg, John Adam St, W.C.2.—Advertised in this issue.

No date stated—Iraq. (1) Light buoys; (2) echo sound machines and equipment for survey depth recorder; (3) ten transformers; (4) lamps, wires, etc; (5) cables and accessories. Documents, fee ID 1s each item, Embassy of the Republic of Iraq, 21 Queen's Gate, S.W.7.

Gazette Announcements

COMPANIES ACTS

M.E.C. Holdings Ltd. Mr H. R. Ross, Remax Hse, 31/32 Alfred Pl, W.C.1, appointed liquidator at extraordinary general meeting on 16 Dec., for the purpose of voluntarily winding-up.

Sears Roebuck and Co. Ltd. Mr C. Reid, 1 Leadenhall St, E.C.3, appointed liquidator at extraordinary general meeting on 10 Dec., for the purpose of voluntarily winding-up.

Barnard and Buecheler Ltd. First annual meeting of creditors to be held at 14 Bryanston St, W.1, on 20 Jan., at 4.30 p.m.

Electric Supply Corpn. (Overseas) Ltd. Mr K. F. Steven, 65 London Wall, E.C.2, appointed liquidator at extraordinary general meeting of members on 31 Dec., for the purpose of voluntarily winding-up.

A. Luce and Co. (Electrical) Ltd. Meeting of creditors to be held at 2 County Bldgs, Land of Green Ginger, Hull, on 14 Jan., at 2.30 p.m.

Permacold Refrigeration Ltd. Petition for winding-up to be heard before High Court of Justice, Strand, W.C.2, on 18 Jan. Persons intending to appear to notify P. Short and Cuthbert, 7 Arundel St, Strand, W.C.2, by 1 p.m., 16 Jan.

Young's Electrical Services Ltd. Meeting of creditors to be held at Hill Hse, Ridgeway, Plympton, on 14 Jan., at 2 p.m.

Partnership Dissolved

Morecambe and Heysham. Partnership between W. Darby, Joan M. Innes and Amy Wood, electrical, television, radio and electronic engineers, carrying on business as William Darby and Co., at Gardner Arcade, Heysham Rd, dissolved as from 11 July.

BANKRUPTCY ACTS

Applications for Discharge

High Court of Justice. L. D. Richards and J. R. Richards, electrical contractors, formerly carrying on business as Streatham Electrics, at 78 Upper Tulse Hill, S.W.2. Order made: discharged subject to certain conditions.

Wolverhampton. H. F. Griffiths, electrical engineer, formerly carrying on business at Central Chmbs, Walsall St, Bilston. Order: discharged subject to certain conditions.

Appointments of Trustees

Gt. Grimsby. D. W. Damms, electrical contractor, carrying on business at 181 Wellington St. Mr L. F. McCulloch, 26 South St. Mary's Gate, Gt. Grimsby, appointed trustee as from 30 Dec.

Harrogate. J. C. Bruce, electrical dealer, carrying on business at 3 Cunliffe Rd, Ilkley. Mr N. Tomblin, 16 Brook St, Ilkley, appointed trustee as from 30 Dec.

York. P. G. A. McCarthy, electrical retailer, trading as Parmac Electrics at 74 and lately in 14 Gillygate. Mr R. W. Hellyer, Brotherton Chmbrs, Westgate, Leeds 1, appointed trustee as from 23 Dec.

Dividends

Manchester. C. Worsley, electrical goods retailer, formerly carrying on business as Happy Service Co. at 56 Faulkner St. Dividend per £: 2s 6d, payable at 47 Mosley St, Manchester 2, on 21 Jan.

Northampton. J. G. Wadsworth, electrical engineer, carrying on business as Nene Rd Electrical Co. at 10 Westfield Terr and formerly at Nene Rd, Higham Ferrers. Dividend per £: 19s 8d (making 20s in all, together with 4% statutory interest), payable at office of Official Receiver, 15 Guildhall Rd, Northampton, on 26 Jan.

TRADE NOTES

Changes of Address. The Manchester depot of Luxram Electric Ltd. is now at 3 Bedlow St, Cholton-on-Medlock, Manchester 1. The telephone number remains Ardwick 5877.

The Glasgow office of High Duty Alloys Ltd. has moved to De Quincey Hse, 48 West Regent St, Glasgow, C.2. Telephone: Douglas 1500.

Agents. Harlec, of South Molton, have appointed Wood's Agencies (Glasgow) Ltd., 375 St. Vincent St, Glasgow, C.3, as their agents for Scotland and Northern Ireland.

Expansion. Nash and Thompson Ltd. have acquired a second factory at Hook Rise, Tolworth.

Representative. J. Day and Co. Ltd. have appointed Mr R. H. Coleman as Midland area representative for their electric cables, covering Birmingham, Warwickshire, Worcestershire, Shropshire, Staffs, Leics, Notts and Derbyshire.

Service Depot. A new service depot for the Materials Handling Division of Yale and Towne Manufacturing Co. has been opened at Ripple Rd South, Barking. Telephone: Dominion 5945.

BUSINESS PROSPECTS

Home

Altrincham B.C. Erection of four three-storey and two four-storey dwellings in New Street area. Architect, F. Bradley, Pennybank Chmbs, 4 Wood St, Bolton.

Antrim C.C. Alterations and additions at Stanocom Primary School, Ballymoney. Education Office, 477 Antrim Rd, Belfast.

Ayr. Dean of Court Guild has approved £93,000 store alterations in High St for F. W. Woolworth.

Basingstoke R.D.C. Erection of 16 bungalows at Belle View Rd. Clerk to the Council, Eastlands, London Rd.

Bath. S. West Regional Hospital Board to seek Ministry approval for £250,000 rebuilding of Royal National Hospital for Rheumatic Diseases.

Bedfordshire C.C. To erect: £23,175 new county primary school, Shillington; £77,051 phase three of Mander College, Bedford; £20,460 extensions and improvements to controlled voluntary primary school, Bromham.

Belfast. Alterations and additions at Belfast Engineering Depot North Post Office, Room 103, Law Courts Building.

Birmingham. Chamberlain, Powell and Bon, 15 Ave Chmbs, Sydney Mews, S.W.3, are architects for £550,000 physical education and sports centre for Birmingham University.

Bradford T.C. Recommended to approve new £500,000 central library at Manchester Rd/Little Horton La.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Acme. 791,776. Class 11. Refrigerators and fires. Acme Domestic Equipment Ltd., 97 David Rd, Glasgow, S.E.

Agfa Magneton. 785,759. Class 9. Magnetic tapes, etc. Agfa Aktiengesellschaft, Leverkusen-Bayerwerk, Germany.

Belling. 790,727. Class 11. Drying apparatus, refrigerators, etc. Belling and Co. Ltd., Bridge Wks, Southbury Rd, Enfield, Middx.

Citenco in design. 792,533 and 792,534. Class 7. Motors. City Engineering Co. (Boreham Wood) Ltd., Manor Way, Boreham Wood, Herts.

Electrovac. 794,267. Class 9. Glass to metal seals for electronic components. Helmut Joseph, Llanvair Lodge, Llanvair Dr, Ascot, Berks.

Global. B780,654. Class 11. Ventilating fans, etc. Verity's Ltd., Hazelwell Wks, Fordhouse La, Stirchley, Birmingham 30.

Lumenar. B.792,329. Class 9. Cathode ray tubes, etc. Mullard Ltd., Torrington Pl, W.C.1.

Marconi and **G. Marconi** in design. 773,492/6. Class 9. Radiogramophones, etc.; thermionic valves, etc. Marconiphone Co. Ltd., Blyth Rd, Hayes, Middx.

Mintem. 790,540. Class 11. All goods. Stabilag Co. Ltd., Mark Rd, Hemel Hempstead, Herts.

PakaTherm. 794,008. Class 10. Heated blankets and pads. Servitor Textiles Ltd., Moorside Mill, Moorside, Oldham, Lancs.

Soutnik. 772,104. Class 9. Igniting appliances, soldering instruments, etc. Allied Distributing Corpn. Ltd., 13-17 Rathbone St, W.1.

Torex. 794,270. Class 9. Electric discharge tubes, semi-conducting devices, etc. Tottenham Radio Valve Co. Ltd., West Rd, N.17.

Transitape. 789,756. Class 9. Apparatus for recording sound, etc. G.B.C. Electronic Industries Ltd., 121/3 Edgware Rd, W.2.

Vendextimer. 794,208. Class 9. Time switches. Autoslave Equipment Ltd., 1/5 Broad St, Northampton.

Wacker in design. 783,028. Class 9. Scientific apparatus, etc. Gebrueder Wacker, 41 Preussenstrasse, Munich 13, Germany.

Bristol T.C. Erection of five-storey block of 34 dwellings at Ashley Down Rd. City Architect.

Carlisle. Johnston and Wright, 13 Castle St, are architects for shop in Fisher St for Pioneer Provision and Grocery Stores Ltd. New Day Furnishing Co. Ltd. are to reconstruct and extend stores in English St to plans by Graham, Roy and Nicholson, 6 Paternoster Row.

Chesterfield T.C. To erect £30,000 first instalment of new school in Storrs Rd. Borough Surveyor.

Chigwell U.D.C. Erection of (1) 48 two-storey houses at Oakwood Hill—phase C; (2) 20 flats at Lambourne Rd, and eight flats at Coopers Close; (3) 14 houses at Lechmere Ave—phase B. Architects: Tooley and Foster, Midland Bank Chmbs, Buckhurst Hill, Essex.

Coventry B.C. Erection of two-form entry junior school at Potters Green. City Architect.

Darlington T.C. Have applied for loan sanction of £250,000 for the erection of 164 houses on Lingfield estate.

Down C.C. Erection of new primary school at Moneyrea. Quantity surveyors: Harris and Partners, 171 Crumlin Rd, Belfast 14.

Dunmurry. Erection of nest of three factories on Site 11 Dunmurry Industrial estate. Room 33, Ministry of Commerce, 64 Chichester St, Belfast.

Enfield B.C. Alterations and extensions to Central Library, Cecil Rd. Engineer and Surveyor, H. D. Peake, 7 Little Pk Gdns.

Esher U.D.C. Erection of Civil Defence Training and Recreational centre. Engineer and Surveyor.

Flintshire C.C. Erection of ambulance H.Q. and garages off Chester Rd//King St By Pass, Mold. County Architect, Llwynegrin, Mold.

Gateshead. Joint Fire Services Committee are to erect a divisional fire station at Dryden Rd.

Hampshire C.C. Erection of Gosport Alverstoke new county infants' school. County Architect, The Castle, Winchester.

Hexham. William Robb and Son Ltd., Fore St, are to build a new store of 40,000 sq ft.

Hinckley U.D.C. Erection of village hall, Hinckley Rd, Stoke Golding. Surveyor, St. Mary's Rd.

Ilford B.C. Alterations at Fairlop Secondary Girls' School, Fencepiece Rd, Barkingside. Borough Engineer.

Isle of Ely C.C. Pig and poultry unit and houses at Meadowgate La, and single-bay fire station at Mepal Rd, Sutton. County Architect, County Hall, March.

Lancashire C.C. Erection of: police house, office, etc., in Garstang Rd, St. Michaels-on-Wyre; branch library at Skelmersdale nr. Ormskirk; phase I of Golborne Culcheth County Primary School; branch library at Formby. County Architect, P.O. Box 26, County Hall, Preston.

Manchester T.C. Erection of Royale Green Infants' School, Northend End; alterations and addition to Gorton Special School. City Architect, Box 488.

Middlesbrough. Kitching and Co., 21 Albert Rd, are architects for alterations in Newton St for R. Sowerby and Son, and alterations to the "Shakespeare Hotel," Linthorpe Rd, for Bass, Ratcliffe and Gretton.

Morpeth R.D.C. Negotiations for purchase of land at Pegswood for the erection of 150 houses proceeding.

Newcastle-on-Tyne T.C. R. W. Gregory and Partners, Pilgrim Hse, Pilgrim St, Newcastle, are heating and electrical consultants for additions to College of Further Education: Richard Turley and Associates, 46 Jesmond Rd, Newcastle, are architects for alterations to Kenton Lodge training college. 1961-62 building programme is expected to include erection of new premises on Cruddas Pk recreation ground to replace Westmorland School. E.C. submitted sketch plans of proposed additions to Bath La College to the M. of E. Architects: W. B. Edwards and Partners, 5-6 Claremont Bldgs.

Norfolk C.C. Work at: King's Lynn new girls' high school; Upwell Secondary Modern School; Contessey Secondary Modern School; Spixworth new three-class primary school; Swaffham Secondary Modern School. Chief Education Officer, F. Lincoln Ralphs, Stracey Rd, Norwich.

Northampton T.C. Erection of 141 flats in two 12-storey blocks at Althorp/Herbert St. Borough Architect, Guildhall.

Northumberland C.C. Branch libraries at Haltwhistle and Longbenton at £15,000 each proposed. Plans are being prepared for health centre at Brunton Pk.

Saffron Walden. Erection of 16 houses. Architect: B. I. Briggs, 7 High St, Gt. Dunmow.

South Shields. Newman Ltd. are planning further extensions to their clothing factory at Commercial Rd.

Southampton T.C. Erection of 72 flats in one 12-storey block on Lansdown Hill redevelopment area. Borough Engineer.

St. Helens T.C. Erection of aged persons hostel Derbyshire Hill Neighbourhood centre. Borough Engineer.

Stokesley R.D.C. To erect new public offices. Surveyor.

Sunderland T.C. To build a child welfare clinic and school medical services' centre on Hylton Castle estate.

Swansea T.C. Erection of additions and adaptations at Llwyn-y-Bryn County Secondary School. Architects: Cook, Rees and Tagholm, Barclays Bank Chmbrs, Wind St. Erection of new school at Dyfatty. Architects: H. A. Ellis and Son, Mardy Chmbrs, 6 Wind St.

Tillicoultry T.C. Erection of 64 dwellings. Burgh Architect, A. G. Bracewell, 36 Walker Terr.

Tynemouth B.C. Erection of aged persons' dwellings in Beadnell Ave, North Shields. Borough Surveyor, 16 Northumberland Sq.

Welton R.D.C. Erection of 20 dwellings at Saxilby, Lincoln. Architects: W. Saunders and Partners, 24 Castle Gate, Newark, Notts.

Worcestershire C.C. Erection of old persons home at Halesowen. County Architect, 14 Castle St, Worcester.

CONTRACTS PLACED

Durham C.C. Electrical work in schools for E.C.: Browney County School, R. Robson, £1,352; Easington Technical College, N. of England Eng. and Electrical Co. Ltd., £257 16s; Felling Wardley County School and Pelton Co. and M.S., Robson and Coleman Ltd., £247 11s and £966, respectively; Consett Technical College, Williams Bros. (Electrical) Ltd., £19,728; and Framwellgate Moor Co. Infants' School, F. E. White, £1,571. Recommended.

E. Durham. Supply of 43 vehicles for Co-operative Dairies, Smith's Delivery Vehicles Ltd.

Enfield B.C. Erection of 102 Group "A" columns and removal of 71 existing columns on London Rd and Southbury Rd, Abacus Eng. Ltd.

Hammersmith B.C. Erection complete of 221 Group "A" columns, Abacus Eng. Ltd.

London C.C. Water heating installations in 175 dwellings on Becontree estate, F. J. Bavnes, £8,758 14s.

Rugby B.C. Electrical services in new Town Hall and Municipal Offices. Lee Beesley and Co. Ltd., £11,946. Recommended.

Tynemouth T.C. Electrical work in improvements at Cullercoats Junior Mixed School, Bonham Electrical Co. Ltd., £247 15s.

West Hartlepool T.C. Electrical work in old people's hostel on Owton Manor estate, Edgar Phillips Ltd.

MEETINGS TO NOTE

THURSDAY, 14 JAN.

I.E.E. (Utilisation Section). "The Application of Power Transistors to the Operation of Gas Discharge Lamps from d.c. Supplies," I. F. Davies and D. Dunthorne. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N. Scotland Sub-Centre). "The Deltic Locomotive," C. M. Cock. Electrical Eng. Dept., Queen's College, Dundee. 7 p.m.

I.E.E. (W. Wales Sub-Centre). "Silicone Electrical Insulation," J. H. Davies. Conference Room, S.W.E.B. Showrooms, The Kingsway, Swansea. 6 p.m.

INSTITUTION OF PLANT ENGINEERS. "Selection of Heating Systems for Factories and Offices," T. Turner. Scottish Bldg Centre, Sauchiehall St, Glasgow. 7.15 p.m.

INSTITUTE OF PHYSICS (Liverpool Branch). "Electronic Applications of Superconductivity," Dr E. Mendoza. Liverpool University. 7 p.m.

I.E.S. (Manchester Centre). "Lighting as an Aid to Police Photography," Det-Sergt H. Martin. Demonstration Theatre, Town Hall Extension, Manchester. 6 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liverpool Section). "The Genealogy of Remote Control," A. L. Hancock, M.A.N.W.E.B. Industrial Development Centre, Paradise St, Liverpool. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Yorks Section). "Automatic Analytical Instruments," G. H. Moss. John Leggot Grammar School, Coal St, Scunthorpe. 7.30 p.m.

FRIDAY, 15 JAN.

I.E.E. (Utilisation Section). Dinner-dance. Café Royal. 7 p.m.

I.E.E. (N. Scotland Sub-Centre). "The Deltic Locomotive," C. M. Cock. Robert Gordon's Technical College, Aberdeen. 7.30 p.m.

I.E.E. (N.E. Graduate and Student Section). "The Design of Power Transformers by Digital Computer," A. C. Hall. Grey Hall, King's College, Newcastle. 6.30 p.m.

INSTITUTE OF PLASTICS (Midlands Section). "Plastics in Electronics." Dr H. A. K. Eden. James Watt Memorial Institute, Gt. Charles St, Birmingham. 6.30 p.m.

INSTITUTE OF PHYSICS (S. Western Branch). "Science on Television," A. J. Garratt. Bristol University. 7 p.m.

INSTITUTE OF PHYSICS (S. Wales Branch). "The Microstructure of Crystalline Solids," Dr J. W. Menter. College of Technology, Newport. 6 p.m.

I.E.S. (Birmingham Centre). Annual dinner at Queen's Hotel, Birmingham.

MONDAY, 18 JAN.

I.E.E. (Informal Meeting). Discussion: "The Reliability and Economy of Cable Installation." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (Mersey and N. Wales Centre). "Radio Aspects of the International Geophysical Year," R. L. Smith-Rose. Donnan Laboratories, Vine St, Liverpool. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). "Electrical Uses of Atomic Spin," G. Phillips. Rutherford College of Technology, Newcastle-on-Tyne 1. 6.15 p.m.

I.E.E. (N. Staffs Sub-Centre). "The Selection of Insulation Levels and Tests for H.V. Transformers," G. B. Harper. Technical College, Stafford. 7 p.m.

I.E.E. (Western Supply Group). "The Design of Electro-Mechanical Auxiliaries Directly Associated with Power-Producing Reactors," A. E. Harwood, P. Scott and B. H. Stonehouse. South Wales Institute of Engineers, Park Pl, Cardiff. 6 p.m.

I.E.E. (Reading District). "Safety in the Use of Electricity in the Factory and in the Home," S. J. Emerson. George Hotel, King St, Reading. 7.15 p.m.

A.S.E.E. (Bristol and West Branch). "Escalators," R. E. Landsbert. Grand Hotel, Bristol. 8 p.m.

BIRMINGHAM ELECTRIC CLUB. "Recent Progress in the Development and Application of Automatic Arc Welding," P. Shaw. Grand Hotel, Birmingham. 6.15 p.m.

IPSWICH AND DISTRICT ELECTRICAL ASSOCIATION. Presidential address, H. C. Waters. Electric Hse, Ipswich. 7.15 p.m.

PHYSICAL SOCIETY EXHIBITION OF SCIENTIFIC INSTRUMENTS at Old and New Horticultural Halls until 22 Jan.

INSTITUTE OF PHYSICS (Manchester Branch). "Recent Developments in Scintillation Counting," Dr J. B. Birks. Manchester University. 7 p.m.

I.E.S. (Bath and Bristol Centre). "Lighting and Other Things in Moscow and Leningrad," A. G. Penny. Gardiner, Sons and Co. Ltd., Broad Plain, Bristol.

TUESDAY, 19 JAN.

I.E.E. (Measurement and Control Section). Discussion: "Superseding the Ratio Arms in A.C. Bridges." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N.W. Measurement and Control Group). "Examples of Geolectric Surveys," Professor L. S. Palmer. Engineers' Club, Albert Sq, Manchester. 6.15 p.m.

I.E.E. (S.E. Scotland Sub-Centre). "Generator/Motor Problems in Pumped-Storage Installations," J. H. Walker. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

I.E.E. (S. Midlands Centre). Faraday Lecture. Birmingham Town Hall. 7 p.m.

A.S.E.E. "The Electrical Association for Women," Miss Mary George. Manson Hse, 26 Portland Pl, W.1. 6.30 p.m.

A.S.E.E. (Aldershot Branch). "Your Water Supply," R. Irvine-Hudson. Queen's Hotel, South Farnborough. 7.30 p.m.

INTERNATIONAL HOTEL AND CATERING EXHIBITION at Olympia until 28 Jan.

MINISTRY OF WORKS. "Space Heating by Electricity," W. M. Stevenson. Fraser's Restaurant, Muir St, Motherwell. 7.15 p.m.

MINISTRY OF WORKS. "Underfloor Heating by Electricity," W. N. Shires. Manchester College of Building, Hardman St, Manchester. 7.15 p.m.

I.E.S. (Hull Centre). "Lighting for Ships," P. Chittenden. Lecture Theatre, Y.E.B., Ferensway, Hull. 6.0 p.m.

I.E.S. (Liverpool Centre). "Lighting and Other Things in Moscow and Leningrad," A. G. Penny, M.A.N.W.E.B. Industrial Development Centre. 6 p.m.

I.E.S. (N. Lancs Group). "Lighting of the Niagara Falls," D. J. Reed. Demonstration Theatre, N.W.E.B., 19 Friargate, Preston. 7 p.m.

I.E.E. (N. Midlands Utilisation Group). "Submersible Pumping Plant," H. H. Anderson and W. G. Crawford. Leeds and County Conservative Club, South Parade, Leeds 1. 6.30 p.m.

WEDNESDAY, 20 JAN.

I.E.E. (Education Discussion Circle). "One Approach to Generalised Machine Analysis." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Measurement and Control Section) AND BRITISH COMPUTER SOCIETY. Discussion meetings on Managerial and Engineering Aspects of Reliability and Maintenance of Computer Systems, and on 21 Jan. Savoy Pl, W.C.2.

I.E.E. (Sheffield Sub-Centre). "The Influence of Consumers' Load/Consumption Characteristics on Metering Practice," L. B. S. Golds. Grand Hotel, Sheffield. 6.30 p.m.

I.E.E. (S.W. Scotland Sub-Centre). "Subscriber Trunk Dialling," D. A. Barron. Institution of Engineers, 39 Elmbank Cres, Glasgow C.2. 6 p.m.

I.E.E. (Rugby Sub-Centre). "New Developments in Electrical Machines," Professor G. H. Rawcliffe. Rugby College of Technology and Arts. 6.30 p.m.

I.E.E. (Southern Centre). "Provision of Adequate Electrical Installations in Buildings," "Commercial Buildings," E. E. Jacobi. University, Southampton. 7 p.m.

I.E.E. (Oxford District). "Electrical Installation Practice," E. J. Sutton. Southern Electricity Board Service Centre, 37 George St, Oxford. 7 p.m.

A.S.E.E. (Wolverhampton Branch). "A.C. Motor Control Gear," S. H. Harding. Chamber of Commerce, District Bank Chmbrs, Lichfield St, Wolverhampton. 7.45 p.m.

ROYAL SOCIETY OF ARTS. "The Function of Management in Industry and Commerce," Sir Frederic Hooper. John Adam St, W.C.2. 2.30 p.m.

INSTITUTE OF WELDING (N. London Branch). "Further Developments in the Welding of Atomic Plant," A. Prince. 54 Princes Gate, S.W.7. 7.30 p.m.

INSTITUTION OF PLANT ENGINEERS (Kent Branch). "Group Routing and Charging Equipment," H. E. Francis. King's Head Hotel, High St, Rochester. 7 p.m.

INSTITUTE OF ELECTRICITY ADMINISTRATION. "Acquisition of Properties," J. E. Williams. Bonnington Hotel, Southampton Row, W.C.2. 6.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. "The Diesel Engine in Association with the Gas Turbine," E. E. Chatterton. 1 Birdcage Walk, S.W.1. 6 p.m.

INSTITUTE OF PHYSICS. "Health Physics," H. J. Dunster. 47 Belgrave Sq, S.W.1. 6 p.m.

THURSDAY, 21 JAN.

I.E.E. (N. Midlands Centre, Hull District). "Domestic Electricity," D. Hardy. Y.E.B. Offices, Ferensway, Hull. 6.30 p.m.

I.E.E. (Western Centre). Faraday Lecture, Professor M. G. Say. Sophia Gdns Pavilion, Cardiff. 6.45 p.m.

I.E.E. (S.W. Sub-Centre). "The Deltic Locomotive," C. M. Cock. Plymouth "B" Generating Station, Prince Rock, Plymouth. 3 p.m.

I.E.E. (Irish Branch). "The Place of Electricity in Irish Agriculture," J. F. Bourke and M. Shiels. Physical Laboratory, Trinity College, Dublin. 6 p.m.

I.E.E. (N. Midlands Graduate and Student Section). "Domestic Electricity," D. Hardy. Y.E.B. Offices, Ferensway, Hull. 6.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Scottish Section). "Micro Miniaturisation," H. G. Manfield. Institution of Engineers and Shipbuilders, 39 Elmbank Cres, Glasgow. 7 p.m.

CHELMSFORD ENGINEERING SOCIETY. "Storage and Manipulation of Information in the Brain," R. L. Beurle. Social Hall, Hoffmann Mnfg. Co. 7.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (E. Midlands Section). "Instrument Research at Stewarts and Lloyds," M. J. Hetherington. College of Technology and Commerce, The Newarke, Leicester. 7.15 p.m.

S. WALES INSTITUTE OF ENGINEERS. Annual dinner. Park Hotel, Cardiff. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Tees-side Section). "The Education of Instrument Engineers," E. J. Charnley. Cleveland Scientific and Technical Institute, Corpn. Rd, Middlesbrough. 7.30 p.m.

FRIDAY, 22 JAN.

A.S.E.E. (Stoke and Crewe Branch). "Earthing and Earth Leakage Protection of Electrical Installations," J. A. Robbins. Royal Hotel, Crewe. 7.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Scottish Section). "Micro Miniaturisation," H. G. Manfield. Dept. of Natural Philosophy, The University, Drummond St, Edinburgh. 7. p.m.

JUNIOR INSTITUTION OF ENGINEERS. "Developments in Engineering Education, Recently and to Come," Dr H. L. Haslegrave. Pepys Hse, 14 Rochester Row, S.W.1. 7 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Advance Domestic Appliances Ltd., 124/6 High St, Edgware, Middx. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £100. Dirs.: Gerald Curtis and Philip Curtis.

A.J.C. Electrics Ltd., Factors and dealers in, merchants of and agents for electrical apparatus, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Jack Gardner and Monty Fisher, 27 Victoria Rd, S.W.1.

Armorduct Trading Co. Ltd., 1-3 Brixton Rd, S.W.9. Manufacturers of, and dealers in, domestic appliances, etc. Nom. cap.: £1,000. Dirs.: Denis S. Wood-Dow, Edward G. Glover and Arthur R. Lockey.

City Appliances Ltd. To carry on business of servicers and manufacturers of and dealers in domestic electrical appliances, etc. Nom. cap.: £100. Dirs.: Bernard M. Ross, Parkgate, Mere, Ches; and Eric Jagger, 334 Hollinwood Ave, Chadderton, nr. Oldham.

Enfield-Standard Power Cables Ltd. To acquire the businesses of the manufacture, marketing and installation of power cables now carried on by (1) Enfield Cables Ltd., and (2) Standard Telephones and Cables Ltd., together with all or any of the assets or liabilities of the said businesses or which may be used in connection therewith, etc. Nom. cap.: £1,000,000. Dirs.: not named. Subs.: John Grimston, Gorhambury, St. Albans, Herts; and F. C. Wright, Easter Barton, Amberley, Sussex.

Kaye Electrical Ltd., 11 St. Anns Rd, Harrow, Middx. Nom. cap.: £5,000. Dirs.: Frederick T. Kaye, Mrs Mabel P. Kaye and Stanley F. G. Kaye.

Pitkin and Ruddock Ltd., 27 Northgate, Beccles. To carry on business of refrigeration and electrical engineers, etc. Nom. cap.: £1,000. Permt. dirs.: Derrick P. Ruddock and Patrick G. Pitkin.

Trade Electric Co. Ltd., 24 Fenwick St, Liverpool, 2. Nom. cap.: £1,000. Dirs.: Frederick W. Elson and Arthur Halliwell.

Craftsmanship
The illustrations show coil winding, and the core and winding assembly of a typical 60 MVA 132/33 kV Hackbridge transformer.

HACKBRIDGE TRANSFORMERS

HACKBRIDGE AND HEWITTIC ELECTRIC Co Ltd

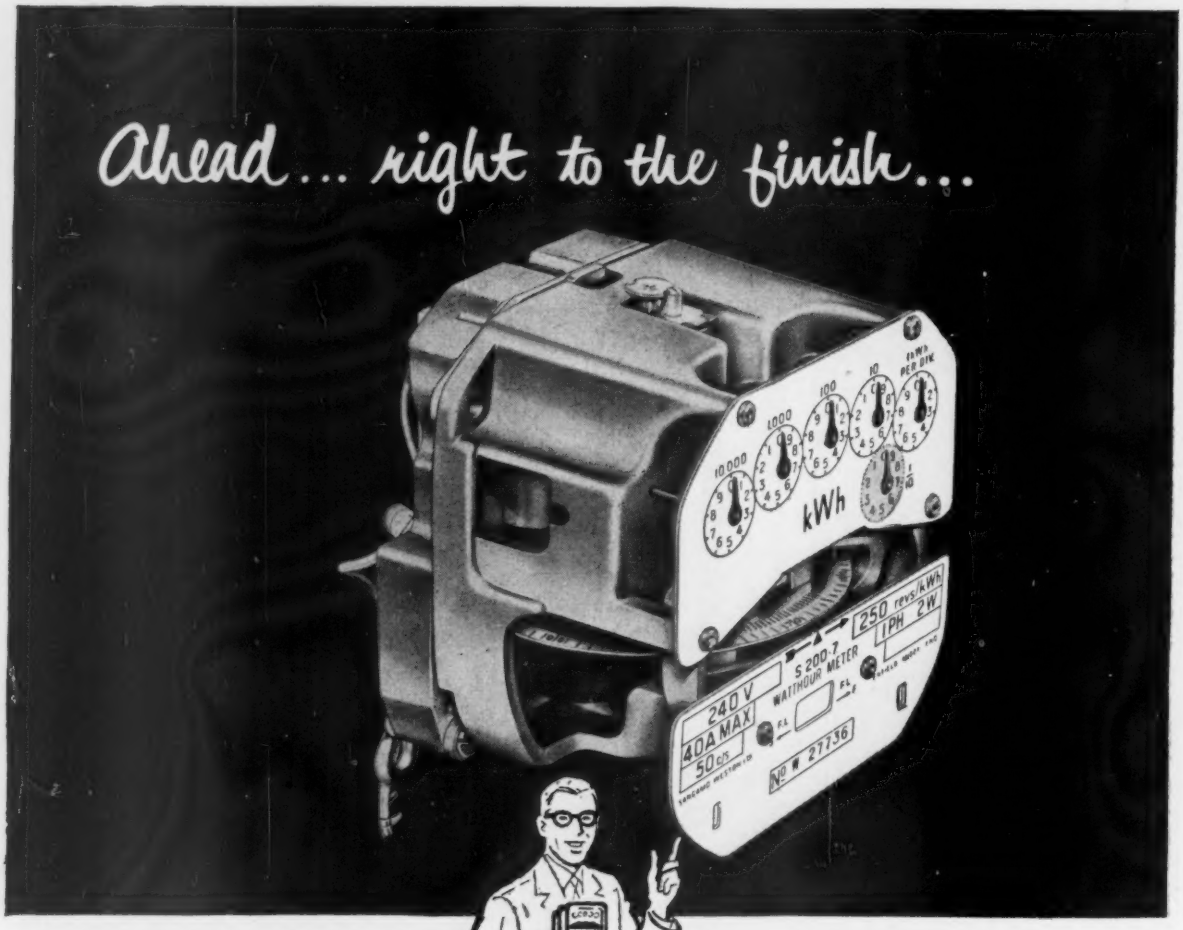
HACKBRIDGE AND HEWITTIC ELECTRIC COMPANY LTD

HERSHAM · WALTON-ON-THAMES · SURREY

Telephone: Walton-on-Thames 28833 *Telegrams & Cables: "Electric, Walton-on-Thames"*

OVERSEAS REPRESENTATIVES: ARGENTINA: H. R. Roberts & Cia., S.R.L. Buenos Aires. **AUSTRALIA:** Hackbridge and Hewittic Electric Co. Ltd., 171 Fitzroy Street, St. Kilda, Victoria; N.S.W.: Queensland: W. Australia: Ed'er, Smith & Co. Ltd.; South Australia: Parsons & Robertson Ltd.; Tasmania: H. M. Bamford & Sons (Pty.) Ltd., Hobart. **BELGIUM & LUXEMBOURG:** Pierre Pollie, Brussels, 3. **BRAZIL:** Oscar G. Mors, Sao Paulo. **BURMA:** Neonlite Manufacturing & Trading Co. Ltd., Rangoon. **CANADA:** Hackbridge and Hewittic Electric Co. of Canada Ltd., Montreal; The Northern Electric Co. Ltd., Montreal, etc. **CEYLON:** Envee Ess Ltd., Colombo. **CHILE:** Sociedad Importadora del Pacifico Ltda., Santiago. **EAST AFRICA:** G. A. Neumann Ltd., Nairobi. **EGYPT:** Giacomo Cohenca Fils, S.A.E., Cairo. **FINLAND:** Sähk -ja Konelilke O.Y. Hermes, Helsinki. **GHANA, NIGERIA & SIERRA LEONE:** Glendova Ltd. **GREECE:** Charilaos C. Coroneos, Athens. **INDIA:** Steam & Mining Equipment (India) Private Ltd., Calcutta; Easun Engineering Co. Ltd., Madras, 1. **IRAQ:** J. P. Bahoshy Bros., Baghdad. **MALAYA, SINGAPORE & BORNEO:** Harper, Gilfillan & Co. Ltd., Kuala Lumpur. **NETHERLANDS:** J. Kater, E.O., Ouderkerk a.d. Amstel. **NEW ZEALAND:** Richardson, McCabe & Co. Ltd., Wellington, etc. **PAKISTAN:** The Karachi Radio Co., Karachi, 3. **SOUTH AFRICA:** Arthur Trevor Williams (Pty.) Ltd., Johannesburg, etc. **CENTRAL AFRICAN FEDERATION:** Arthur Trevor Williams (Pty.) Ltd., Salisbury. **THAILAND:** Vichien Phanich Co. Ltd., Bangkok. **TRINIDAD & TOBAGO:** Thomas Peake & Co., Port of Spain. **TURKEY:** Dr. H. Salim Oker, Ankara. **U.S.A.:** Hackbridge and Hewittic Electric Co. Ltd., P.O. Box 234, Pittsburgh 30, Pennsylvania. **VENEZUELA:** Oficina de Ingenieria Sociedad Anonima, Caracas.

Ahead... right to the finish...



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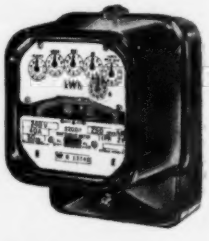

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CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

CITY OF MANCHESTER
Housing Committee

TENDERS invited (returnable noon 25 Jan., 1960) for ELECTRICAL INSTALLATIONS to the following:
Contract 265, 48 dwellings, Levenshulme.
Contract 222F, 2 Surgeries, Ridgway St.
Documents obtainable from Director of Housing, Town Hall, Manchester 2. (N 580)

FRIERN BARNET URBAN DISTRICT COUNCIL
Annual Tenders

TENDERS are invited for the supply and delivery of street lighting lamps for 12 months commencing 1 April, 1960.
Specification and Form of Tender, etc., may be obtained from the Engineer and Surveyor, Town Hall, N.11.
Tenders are to be delivered to the undersigned not later than 10 a.m. on Wednesday, 3 Feb., 1960.

R. S. CLOTHIER,
Clerk of the Council.

Town Hall,
N.11.
7 Jan., 1960. (N 574)

COUNTY BOROUGH OF GREAT YARMOUTH
Annual Contracts

THE Council invite tenders for the supply of electric cables for a period of one year from 1 April, 1960. Specifications, Forms of Tender and Conditions of Contracts may be obtained from the Borough Engineer, Town Hall, Great Yarmouth.
Tenders, on the forms supplied, in a plain sealed envelope endorsed "Tender for Electric Cables," must reach me not later than Friday, 29 Jan., 1960.
No guarantee is given that the lowest or any tender will be accepted.

FARRA CONWAY,
Town Clerk.

Town Hall,
Great Yarmouth.
12 Jan., 1960. (N 581)

BOROUGH OF NEWBURY
Sewage Effluent Pumping Station

TENDERS are invited for the supply and installation of three electrically driven Vertical Spindle Suspended Axial Flow Propeller Pumps, each capable of dealing with 2,014 gallons per minute.
Specification, Drawings and Forms of Tender may be obtained from the Borough Surveyor, Municipal Buildings, Newbury, at whose office the Conditions of Contract may be inspected.
Tenders endorsed "SEWAGE EFFUENT P.S." to be received by the undersigned not later than Saturday, 6 Feb., 1960.
The Corporation does not bind itself to accept the lowest or any tender.

LESLIE SOUTHERN,
Town Clerk.
(N 573)

NEW ZEALAND GOVERNMENT RAILWAYS

TENDERS are invited from manufacturers of Locomotive Electrical Equipment for the supply of Diesel-Electric Equipment for 400/450 h.p. 3 ft 6 in. gauge Diesel Electric Shunting Locomotives which are to be built in New Zealand by the Railways

continued in next column

continued from previous column

Department. Tenders are due to close in New Zealand on Friday, 11 March, 1960, and specifications can be obtained on receipt of written application to: The Chief Purchasing Officer, New Zealand Government Office (Ref. C/F.99/2783), Adelphi Bldg, John Adam St, London W.C.2. (N 575)

APPOINTMENTS VACANT

CITY OF SHEFFIELD
APPOINTMENT OF PUBLIC LIGHTING ENGINEER

APPLICATIONS are invited from persons possessing necessary qualifications and experience for appointment to the post of Public Lighting Engineer on Scale B of J.N.C. for Chief Officers—commencing salary £1,315 rising by annual increments (one of £60, two of £55 and one of £45) to £1,530 per annum. Wide knowledge of street lighting, both gas and electricity, is essential.
The appointment is a whole-time one, superannuable, and subject to medical examination.
Applications on the official form, to be obtained from me, must be addressed to and received by me not later than the 30 Jan., 1960.
Canvassing, direct or indirect, will disqualify.

JOHN HEYS,
Town Clerk.

Town Hall,
Sheffield 1. (N 535)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division
OPERATION SUPERINTENDENT

REQUIRED at Hams Hall "A" Power Station. N.J.B. service conditions, superannuable appointment salary within Schedule A, Grade K5, £1,360/£1,450.
Applicants should have received a sound technical and practical training, and should have considerable experience in the operation and maintenance problems arising in a large modern power station. The possession of a recognised technical qualification will be an advantage.
Apply, quoting Vacancy Number 3/60MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 25 Jan., 1960. (N 556)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division
SHIFT CHARGE ENGINEER

REQUIRED at Hams Hall "B" Power Station, near Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K7, £1,195/£1,270 per annum.
A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear in a large modern power station are required; also a knowledge of P.F. firing. Appropriate qualifications an advantage.
Apply, quoting Vacancy Number 2/60MD on form AE6, available from Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 25 Jan., 1960. (N 558)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

Area Board Headquarters
CHIEF ENGINEER'S DEPARTMENT

ASSISTANT SYSTEM CONTROL ENGINEER (SHIFT DUTIES) with location at the Board's Sub-Control Centre, Aykleyheads, Durham City. The successful applicant will be given suitable training and will be required to assist in the centralised control and operation of high voltage interconnected distribution networks operating at voltages up to 66 kV. Applicants should, preferably, possess H.N.C. in Electrical Engineering or equivalent qualification and be conversant with operation and maintenance of H.V. distribution equipment. Knowledge of district work or protective gear operation an advantage. Starting salary according to qualifications and experience and within the range of Schedule B, Grade 6, £1,017 10s/£1,254 inclusive of 10% shift allowance. N.J.B. conditions of service.

Wear Sub-Area

FIRST ASSISTANT DISTRICT ENGINEER, Sunderland District. Applicants must be suitably qualified electrical engineers with sound practical training and experience in construction, operation and maintenance of overhead and underground networks and associated plant and equipment. Salary: Schedule A, Class F, Grade 4, £1,095/£1,170. N.J.B. conditions of service.
Applications stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O., Box No. 117, Carliol Hse, Newcastle upon Tyne, within 10 days of the appearance of this advertisement. (N 585)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD
(a) THIRD ASSISTANT ENGINEER (PROTECTION)
(b) FOURTH ASSISTANT ENGINEER (PROTECTION)

REQUIRED in the Board's No. 2 Sub-Area Headquarters.
(a) Applicants should have had experience of testing and commissioning of H.V. electrical plant and its associated protective gear, an ability readily to interpret wiring diagrams, and a knowledge of calculations required to determine protective relay settings. They should be in possession of appropriate technical qualifications.
Salary within range £965/£1,025 per annum (N.J.B., K/10).
(b) The duties will include testing and commissioning switchgear, transformers and associated equipment up to 33 kV. Applicants should possess appropriate technical qualifications.
Salary within range £815/£860 per annum (N.J.B., K/13).
Appointments subject to medical examination. Pension scheme.
Application forms, obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Northwich, Cheshire, should be returned not later than 25 Jan., 1960. (N 591)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division
ASSISTANT ENGINEER (TECHNICAL RECORDS)

REQUIRED at Hams Hall "B" Power Station, Nr. Birmingham. N.J.B. service conditions, superannuable appointment, salary in accordance with Grade K12 (£860/£905 per annum).
Applicants should have received a sound technical training and practical experience in power station engineering and should be interested in statistical work. A recognised technical qualification will be an advantage.
Apply, quoting vacancy number 8/60MD on Form AE6 available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 25 Jan., 1960. (N 592)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

NEW ZEALAND MINISTRY OF WORKS
ENGINEERING STAFF

THE New Zealand Ministry of Works invites applications for the following vacancies on the Permanent Staff. Positions, qualifications desired and salaries offered are as follows:

Vacancy No. 3.
MECHANICAL OR ELECTRICAL ENGINEERS

Corporate Membership of the Institutions of Mechanical or Electrical Engineers, London, together with sufficient appropriate experience. Commencing salaries up to £1,525 p.a.

Vacancy No. 4.
BUILDING SERVICES ENGINEERS

Corporate Membership of the Institution of Heating and Ventilating Engineers, London. Commencing salaries up to £1,450 p.a.

Vacancy No. 5.
ASSISTANT MECHANICAL OR ELECTRICAL ENGINEERS

A university Degree in Mechanical Engineering or Graduate Membership of the Institutions of Mechanical or Electrical Engineers, London, together with at least five years' experience since commencement of pupilage. Commencing salaries: £870/£1,060 p.a.

Vacancy No. 6.
ASSISTANT BUILDING SERVICES ENGINEERS

Graduate Membership of the Institution of Heating and Ventilating Engineers, London, with at least five years' experience since commencement of pupilage. Commencing salaries £870/£1,060 p.a.

Experience is necessary in the design and installation of services or equipment for one or more of the following: heating and ventilating, air conditioning, hot and cold water or sewerage services, laundries, kitchens, boiler-houses, lifts and other mechanical services in offices, schools, hospitals, hotels, telephone exchanges, printing works, defence establishments, etc. All appointees will be required to undertake work of this nature.

Applicants must be Resident in the United Kingdom or Eire and have fulfilled National Service obligations.

Enquiries, mentioning this publication and stating the Vacancy Number and the position sought, should be addressed to the High Commissioner for New Zealand, 415 Strand, London W.C.2. Full details of duties, experience required, general information on the conditions of employment in the New Zealand Public Service and application forms will then be supplied. (N 528)

CENTRAL ELECTRICITY GENERATING BOARD
North Eastern and Yorkshire Region
THIRD ASSISTANT ENGINEER

APPLICATIONS are invited for the appointment of Third Assistant Engineer (Electrical) in the Yorkshire Division, Transmission Department, based on Leeds.

The successful applicant will be required to assist in the engineering and site supervision of contracts for the manufacture, supply and erection, of plant and equipment at Grid Substations. He should have a sound technical and practical training with experience of the construction of high-voltage substations and preferably of operation and maintenance additionally.

Preference will be given to those candidates who are Chartered Electrical Engineers or hold equivalent qualifications.

Salary will be in accordance with the National Joint Board Agreement, Class AX/EX, Grade 5 (£1.090/£1,355 per annum), or Grade 6 (£925/£1,170 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 25 Jan., 1960. (N 553)

CENTRAL ELECTRICITY GENERATING BOARD
South Wales Division
Vacancy No. 2/ET/60.

APPLICATIONS are invited for superannuable N.J.B. appointment of FOURTH ASSISTANT ENGINEER, MEASUREMENTS SECTION, TECHNICAL DEPARTMENT.

Salary: Grade AX/DX8, £735/£935 per annum.

H.N.C. or equivalent qualification desirable.

The work of this Section involves precision measurements by means of potentiometer equipment, integrating meters, indicating instruments and electronic devices. Additional duties concern the acceptance testing of new generators, efficiency testing of existing plant, the initiation of signals for remote indication and much new development.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 25 Jan., 1960. (N 564)

SOUTH EASTERN GAS BOARD
Isle of Grain Works
ELECTRICAL ENGINEER

APPLICATIONS are invited for the appointment of Electrical Engineer at the Isle of Grain Works of the Board.

The electrical installation will comprise a power house having a capacity of 9,500 kW, operating in parallel with the public supply system, with associated high and low voltage distribution systems, a.c. and d.c. motors and control gear.

Applicants should preferably be Corporate Members of the Institution of Electrical Engineers, and must have extensive practical experience in the operation, control and maintenance of back pressure turbine and oil engine-driven alternators, high and low voltage switchgear, power cabling, mercury arc rectifiers, a.c. and d.c. motors, control gear and automatic control systems.

Salary within range £1,235/£1,533 per annum, according to qualifications and experience.

Applications in writing, quoting reference V19/1155, and giving full details to the Personnel Manager, South Eastern Gas Board, Katharine St, Croydon, Surrey, within seven days. (N 555)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Birmingham & District Sub-Area
FOURTH ASSISTANT ENGINEER
(TRANSMISSION SECTION, HEADQUARTERS)

Experience necessary in the installation, operation and maintenance of switchgear, transformers, cables and protective equipment on circuits up to and including 33 kV. Technical qualifications desirable. Salary £910/£1,025 per annum (N.J.B. Grade M.13/12) according to qualifications and experience. Apply, by letter, within 14 days, stating age, experience, qualifications, present salary and position to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

Shropshire & Herefordshire Sub-Area
THIRD ASSISTANT DISTRICT ENGINEER
(WELLINGTON)

Duties include the construction, maintenance and operation of H.V. and L.V. mains and substations, and applicants should have had experience in the planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary £815/£860 per annum (N.J.B. Grade F.9). Apply, by letter, within 14 days, stating age, qualifications, experience, present position and salary to Mr. W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gdns, Ditherington, Shrewsbury.

F. W. CATER,
Secretary.
(N 566)

CITY AND COUNTY OF BRISTOL EDUCATION COMMITTEE
Bristol Technical College
DEPARTMENT OF ENGINEERING

THE above College is being formed by the separation, as from 1 Sept., 1960, of the present College of Technology into a College of Advanced Technology and a Regional College, the Bristol Technical College. The Governors invite applications for the following new posts, to take effect from 1 May, 1960. Applicants should be Graduates or equivalent with industrial, teaching and preferably some administrative experience. The Department will provide courses in Mechanical and Electrical Engineering up to Ordinary National Certificate level, together with all craft courses in Engineering. The successful candidates will be directly responsible to the Head of Department for the appropriate section:

1. SENIOR LECTURER in Mechanical Engineering.
2. SENIOR LECTURER in Electrical Engineering.

Burnham Technical Scale salary, £1,550 x £50—£1,750 per annum.

Application forms, returnable as soon as possible, and details from Registrar, College of Technology, Ashley Down, Bristol 7. (N 572)

CENTRAL ELECTRICITY GENERATING BOARD
North Eastern and Yorkshire Region
THIRD ASSISTANT ENGINEER
TECHNICAL DEPARTMENT

APPLICATIONS are invited for an appointment as Third Assistant Engineer in the System Design Section, based on Divisional Headquarters, Leeds.

Applicants should possess technical qualifications leading to Corporate Membership of the I.E.E., and be experienced in calculations relating to high-voltage generation and transmission systems and to reinforcements thereof.

The salary for the appointment will be in accordance with the National Joint Board Agreement (£925/£1,170 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 25 Jan., 1960. (N 554)

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position:

SECOND ASSISTANT DISTRICT ENGINEER
(OVERHEAD CONSTRUCTION)
EXETER

Salary according to Class G, Grade 7, £965 x £20—£1,025 per annum, of Schedule A of the N.J.B. Agreement.

The successful candidate will be responsible for the supervision and construction of overhead lines and substations throughout the District and some underground works as required for voltages up to and including 33 kV. The duties will include the preparation of construction programme, costing of works, efficiency investigations and development of the use of mechanical aids.

Applicants must possess initiative and the ability to take responsibility and to control men. Corporate membership of the Institution of Electrical Engineers or equivalent qualifications and possession of a current driving licence will be an advantage.

Applications for the above post to be made on standard form AE6/ACT, OBTAINABLE BY POSTCARD ONLY, from the District Manager, South Western Electricity Board, 3 Bedford St, Exeter. Closing date for receipt of completed applications is 30 Jan., 1960. (N 552)

Box Number replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

SOUTH OF SCOTLAND ELECTRICITY BOARD

Ayrshire Area

APPLICATIONS are invited for the following superannuable posts:

(1) FOURTH ASSISTANT ENGINEER (METERS, TEST AND PROTECTION)
AREA HEADQUARTERS, KILMARNOCK

Salary: N.J.B., Schedule A, Class J, Grade 13 (£765/£810 per annum).

Applicants should have had experience in the commissioning and routine testing of protective, substation and mains equipment up to 33 kV.

(2) GENERAL ASSISTANT DISTRICT ENGINEER
KILMARNOCK

(3) GENERAL ASSISTANT DISTRICT ENGINEER
AYR

Salary: N.J.B., Schedule A, Class F, Grade 11 (£710/£755 per annum).

Applicants should have had experience in overhead and underground systems up to 33 kV.

The minimum qualification for any of these posts is an Ordinary National Certificate in Electrical Engineering. The successful applicants will require to reside within a reasonable distance of their respective headquarters.

Application forms, which may be obtained from Mr. G. F. Moore, Manager, Greenholm St, Kilmarnock, should be returned indicating the post applied for not later than 29 Jan., 1960. (N 560)

BRITISH STANDARDS INSTITUTION

TECHNICAL STAFF

THE B.S.I. invites applications from Electrical Engineers to join the technical staff of the Institution. This staff is responsible for the work of the Institution in the preparation of British Standards in co-operation with the various sections of industry and is required to plan and progress the work. They act as secretaries to technical committees.

Applicants should have a university degree or equivalent professional qualification in electrical engineering.

There are three grades of appointment, with an overall salary range up to £2,000 plus: applications are invited for the basic grade, the starting salary being dependent on individual qualifications and experience. The posts are pensionable.

Apply to the Establishment Officer, B.S.I., 2 Park St, London W.1. (N 551)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Vacancy No. 4/60.

THIRD ASSISTANT ENGINEERS
(TECHNICAL DEPARTMENT)
BASED AT BRIGHTON AND NORTHFLEET

CANDIDATES must possess H.N.C. in Electrical Engineering or equivalent qualification and have some knowledge of system technology, including calculations dealing with balanced and unbalanced conditions.

Experience in the following aspects of Technical Department work is essential:

1. Installation and maintenance of all types of automatic protective gear associated with the main transmission system and in power stations.

2. Commissioning tests on alternators, transformers and switchgear, including the preparation and co-ordination of testing programmes.

3. Fault investigation and preparation of reports.

4. Correspondence on electro-technical matters.

Salary within range £1,090/£1,320, plus London Allowance where applicable.

Applications giving age, details of experience, qualifications, etc., to Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames. CLOSING DATE 25 JAN., 1960. (N 567)

GOVERNMENT OF THE FEDERATION OF NIGERIA

TECHNICAL INSTRUCTOR
(ELECTRICAL PRACTICE)

REQUIRED to give instruction in Electrical Practice at the Yaba Technical Institute, Lagos.

The candidate must have served a full apprenticeship and be an experienced practical tradesman. He should possess a Final City and Guilds Certificate in Electrical Engineering Practice which must include in Part II of the Final, Sections B and C—Generation and Transmission, and Distribution, etc.; or a City and Guilds Electrical Technicians' Certificate in Power Generation and Supply.

It would be an advantage if the candidate could offer instruction in Radio Service Work and preference will be given to candidates having experience of apprenticeship training or teaching.

Minimum age 25 years.

Appointment on contract for up to three institutional tours of nine to ten months with prospect of extension.

Salary, according to qualifications and experience, £834/£1,386 per annum (including Inducement Allowance), plus 10% cost of living award, pending revision of salaries.

Gratuity of £100/150 per annum for satisfactory service. Outfit allowance of £60. Free passages for officer and wife and liberal leave on full pay. Quarters at low rent. Income Tax at low local rate. Assistance towards children's passages or grant while separated.

Candidate should write for application forms and further particulars, stating age, qualifications and experience within ten days of publication of advertisement to the Appointments Secretary, Federal Public Service Commission, 9 Northumberland Ave, London W.C.2, quoting G./17/13. (N 537)

HUNTINGDONSHIRE

St. Neots Technical Institute

ASSISTANT, GRADE A

REQUIRED as soon as possible to teach Mathematics, Science and Technical Drawing, mainly with full-time first-year Craft and S.1 students. This post offers an opportunity to young engineers, with five years' experience, who wish to gain some teaching experience. Minimum qualification O.N.C. Superannuation transferable from Nationalised Industries.

Details and forms of application in connection with this post obtainable from the undersigned, to whom they should be returned as soon as possible.

I. C. CURREY,
Director of Education.

Gazeley Hse,
Huntingdon. (N 436)

GRENADA, WINDWARD ISLANDS

CHIEF ENGINEER
ELECTRICITY DEPARTMENT

APPLICATIONS are invited for the above pensionable appointment. Salary equivalent to £1,500 a year. Quarters will be provided at a rental of 10% of officer's salary. Free first class passages for officer, wife and three dependent children under 18 years. Liberal leave on full salary. Candidates must possess a university degree or equivalent diploma in electrical engineering, or be Graduate or Corporate Members of the Institution of Electrical Engineers with appreciable electrical engineering experience. They must have held a responsible position for a minimum of three years with a well established engineering concern providing wide experience in electrical engineering practice. The duties will include supervision of the plant of the Power Station including ice-making plant and the Colony's electric light system, and the carrying out of any extension of electricity as may be decided on from time to time.

Applications should be addressed to the Secretary, Public Service Commission, Grenada, West Indies, and should reach him on or before 1 Feb., 1960. (N 542)

CENTRAL ELECTRICITY GENERATING BOARD

Yorkshire Division

APPLICATIONS are invited for the appointment of STATION CHEMIST at Blackburn Meadows Power Station, Sheffield.

Salary: £1,025/£1,085 per annum, Class H, Grade 7, National Joint Board Agreement.

Applicants should hold the Higher National Certificate in Chemistry and preferably have had power station experience.

Application forms obtainable from the Divisional Secretary (Establishments), Central Electricity Hse, St. Mary's Rd, Leeds 7, to be returned within 14 days of the appearance of this advertisement. (N 550)

THE SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER

APPLICATIONS are invited for the position of Assistant Engineer in the Swansea and West Central Area of the Board.

The salary for the position will be in accordance with Class L, Grade 10 (£1,025/£1,085 per annum), of the National Joint Board Agreement for the Electricity Supply Industry.

Applications stating age, present position, present salary, qualifications and experience, should be addressed to G. R. T. Edwards, B.SC., M.I.E.E., M.AM.I.E.E., Manager, Swansea and West Central Area, 29 Ystrad Rd, Swansea Industrial Estate, Swansea, Glam, so as to reach him not later than 27 Jan., 1960. (N 541)

PATENT EXAMINERS AND PATENT OFFICERS

PENSIONABLE posts for men or women for work on the examination of Patent applications. Age at least 21 and under 29 on 31 Dec., 1960, with extension for regular Forces Service and Overseas Civil Service. Qualifications: normally first- or second-class Honours Degree in physics, chemistry, engineering or mathematics, or equivalent attainment, or professional qualification, e.g., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C. London salary (men) £655/£1,460; provision for starting pay above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley St, London W.1, for application form, quoting S128/60. (N 570)

THE SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER

APPLICATIONS are invited for the position of Assistant Engineer (Brecon) in the Mid Wales and North Mon District of the Monmouthshire and Mid Wales Area of the Board.

The salary for the position will be in accordance with Class E, Grade 7 (£860/£905), of the National Joint Board Agreement for the Electricity Supply Industry.

Applications stating age, present position, present salary, qualifications and experience should be addressed to D. G. Gwyn, B.SC., A.M.I.E.E., Manager, Monmouthshire and Mid Wales Area, Albany Chmbrs, Skinner St, Newport, Mon, so as to reach him not later than 27 Jan., 1960. (N 540)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 1/ET/60.

APPLICATIONS invited for superannuable N.J.B. appointment of STATION SHIFT CONTROL ENGINEER at UPPER BOAT POWER STATION.

Salary: H.10, £860/£905 per annum.

Applicants should possess H.N.C. or equivalent.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 21 Jan., 1960. (N 565)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Liverpool North District of the Board's No. 1 Sub-Area:

(a) FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER

Salary within range £1,270/£1,360 per annum (N.J.B., J/5).

The candidate appointed will be responsible to the District Commercial Engineer for the organisation, control and operation of the Contracting and Installation Inspection Sections, assistance in negotiations with consumers in connection with additional supplies, load development, etc.

Applicants should have wide experience on the commercial side of the Electricity Supply Industry, and should possess appropriate technical qualifications.

(b) CONSUMERS' ENGINEER

Salary within range £1,025/£1,085 per annum (N.J.B., J/8).

The duties include responsibility to the First Assistant District Commercial Engineer for the control and operation of the service section dealing with estimating and specifications for contracting work, advising consumers on electricity supply matters, etc.

Applicants should possess appropriate technical qualifications.

(c) ASSISTANT CONSUMERS' ENGINEER (1)

Salary within range £860/£905 per annum (N.J.B., J/11).

Duties include estimating and preparation of specifications for contracting work, advising consumers on matters relating to electricity supply and utilisation of electrical equipment.

Applicants must have completed an electrical apprenticeship and possession of technical qualifications is desirable.

(d) ASSISTANT CONSUMERS' ENGINEER (2)

Salary within range £710/£755 per annum (N.J.B., J/14).

The post offers an opportunity to a young man who has completed an electrical apprenticeship and made progress in his technical studies.

Appointments subject to medical examination. Pension scheme.

Apply to the Manager, No. 1 Sub-Area, 24 Hatton Gdn, Liverpool 3, for special application forms, indicating the vacancy in which you are interested. Closing date for return of applications: 31 Jan., 1960. (N 582)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

GENERAL ASSISTANT ENGINEER

REQUIRED at Worcester Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade E.12, £610/£655 per annum.

Applicants should have received a sound technical training, and should preferably hold the Higher National Certificate in mechanical or electrical engineering. Duties will be of a general technical nature including the preparation of the power station statistics.

Apply, quoting vacancy number 1/60MD on form AE6, available from the Establishments Officer, Central Electricity Generating Board, 53 Wake Green Rd, Moseley, Birmingham 13, by 25 Jan., 1960. (N 557)

THE ELECTRICITY COUNCIL

ASSISTANT TO THE REGIONAL SAFETY OFFICER

THE Electricity Council require an **Assistant** to the **Regional Safety Officer,** Headquarters in Bristol. Candidates should have good engineering qualifications, a knowledge of the Factories Acts and Safety Regulations, and preferably some experience in accident prevention in the electricity supply industry. Salary within N.J.B., Grade 4 (£1,195/£1,545 p.a.). Applications stating age, salary and giving full details of qualifications and experience to E. Landucci, The Electricity Council, Winsley St, W.1, to arrive not later than 30 Jan., 1960. Quote ref. ET/63. (N 594)

YORKSHIRE ELECTRICITY BOARD
No. 5 (Wakefield) Sub-Area

WAKEFIELD DISTRICT

DISTRICT SENIOR CLERK

THE successful applicant will be responsible for all clerical work in the District including stores, collection of accounts, meter reading and commercial records.

Possession of a recognised qualification will be an advantage.

Salary: N.J.C., Grade 7 (£1,070 x £30—£1,160 per annum).

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 29 Jan., 1960.

No. 4 (Leeds) Sub-Area

LEEDS DISTRICT

FOURTH ASSISTANT DISTRICT ENGINEER

Applicants should have gained the H.N.C. in Electrical Engineering or equivalent qualifications and have experience in M.V. and H.V. construction, operation and maintenance and design of overhead and underground distribution systems and substations.

The successful candidate will be expected to reside in the District and undertake standby duties.

Salary: N.J.B., Class K, Grade 11 (£910 x £15—£955 per annum).

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Nr. Leeds, not later than 29 Jan., 1960.

No. 6 (Hull) Sub-Area

SENIOR DRAUGHTSMAN (ELECTRICAL)

Applicants should have experience in the layout of supply networks and of primary and other substations and in the preperation of drawings and diagrams of system layouts and electrical equipment. A knowledge of building construction and civil engineering work will be an advantage.

Salary: N.J.B., Schedule D, Grade 5 (£790 x £20—£890 per annum).

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 29 Jan., 1960. (N 583)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

SENIOR COMMERCIAL ASSISTANT (AGREEMENTS)

APPLICATIONS are invited for the above post at the Area Office, Dingwall.

Candidates should be qualified to advise prospective consumers on tariffs and conditions of supply and to negotiate Agreements.

Salary: £720/£960 (N.J.C., Grade 3-5) with placing according to qualifications and experience. Superannuation scheme.

Applications stating age, qualifications and experience to be forwarded to the Area Manager, Church St, Dingwall, by 30 Jan., 1960. (N 593)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD
Dundee Area

APPLICATIONS are invited for the post of ASSISTANT CHARGE ENGINEER at Carolina Port Power Station.

Experience in control and operation of generation plant and technical qualifications of Higher National Standard are desirable.

Salary is in accordance with Class F, Grade 9 (£815 x £15—£860) of the National Joint Board Agreement, plus 10% Shift Allowance. Superannuation scheme.

Application forms are obtainable from Area Manager, 7 Dudhope Crescent Rd, Dundee, and should be returned by 24 Jan., 1960. (N 590)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (CIVIL)

SUB-AREA Engineering Department of No. 2 (Newbury) Sub-Area. Salary: N.J.B., Class M, Grade 13 (£910 x £15—£955 per annum). N.J.B. conditions of service.

Applicants should have experience in the construction of new works in reinforced concrete, steelwork and associated materials and the maintenance of industrial, office and showroom premises.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1150, not later than 25 Jan., 1960.

GENERAL ASSISTANT ENGINEER

Weymouth District of No. 4 (Bournemouth) Sub-Area. Salary: N.J.B., Class F, Grade 10 (£765 x £15—£810 per annum). N.J.B. conditions of service.

The successful candidate will be required to assist the Planning Engineer in the preparation of schemes and estimates for extensions of, and reinforcement to, overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in electricity supply distribution, and the possession of suitable technical qualifications will be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z.1074, not later than 25 Jan., 1960.

ENGINEERING DRAUGHTSMAN (CIVIL)

Sub-Area Engineering Department of No. 2 (Newbury) Sub-Area. Salary: N.J.B., Grade 6, Schedule D (£620 x £20—£740 per annum). N.J.B. conditions of service.

Applicants should have had a good technical training and be experienced in the preparation of plans and detailed drawings of buildings and Civil Engineering works, including substations, service centres, workshops and offices.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1149, not later than 25 Jan., 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (N 586)

CENTRAL ELECTRICITY GENERATING BOARD
South Eastern Division

THIRD ASSISTANT ENGINEER (TECHNICAL)

DIVISIONAL HEADQUARTERS, KINGSTON

APPLICANTS must possess the Higher National Certificate in Electrical Engineering or equivalent qualifications and have some knowledge and experience of modern protective gear practice as applied in the Authority's Power Stations and on its Transmission System. Ability to make calculations appropriate to the calibration and coordination of relay settings and to write a good report is most desirable.

N.J.B., conditions of service and salary Class AX/DX, Grade 6 (£975/£1,190 p.a. including London Allowance).

Applications, giving details of education, experience, present position, etc., should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston, to arrive by 22 Jan., 1960. (N 577)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

DEMONSTRATOR

REQUIRED in the Liverpool South District. Salary will be within the range £525/£625 per annum (N.J.C., Grade 1) according to qualifications and experience.

Applicants should possess a recognised diploma in domestic science or other approved qualifications and should preferably have had training and experience in the demonstration and use of electric cookers and other domestic electrical appliances.

Pension scheme. Appointment subject to medical examination.

Applications stating age, previous experience, etc., should be forwarded to the Manager, No. 1 Sub-Area, 24 Hatton Gdn, Liverpool 3, not later than 25 Jan., 1960. (N 589)

EAST AFRICAN RAILWAYS AND HARBOURS

DRAUGHTSMAN GRADE IV/III
(ELECTRICAL)

REQUIRED on probation for two years with prospects of permanent and pensionable employment. Commencing salary according to age and experience in scale (including Inducement Pay), £863 rising to £1,134 a year. Outfit Allowance £30. Free passages. Liberal leave on full salary after each tour of 36-45 months. Candidates preferably under 40 years of age must have served full apprenticeship in an engineering firm or equivalent organisation with subsequent experience as an electrical engineering draughtsman. Acquaintance with I.E.E. wiring regulations (13th Edition) and British Standard codes for electric wiring in buildings and workshop electrical installations required. Knowledge of indenting from working and layout drawings an advantage. Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/50887/EE. (N 538)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

NEW SUB-AREA SYSTEM CONTROL CENTRE
CHALTON, Nr. LUTON

(a) THIRD ASSISTANT ENGINEERS (SYSTEM CONTROL) 5/60.N.

(b) FOURTH ASSISTANT ENGINEERS (SYSTEM CONTROL) 6/60.N.

Candidates should have had a sound technical training together with experience of switching operations and maintenance work on H.V. distribution equipment. A knowledge of protectve systems is desirable.

Salary: N.J.B., Class L (a) Grade 10 (£1,025/£1,085) plus 10% Shift Allowance with minimum of £90; (b) Grade 13 (£860/£905) plus 10% Shift Allowance with minimum of £90.

Apply by letter to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend St, Bedford, by 29 Jan., 1960.

BEDFORD DISTRICT
FOURTH ASSISTANT ENGINEER 7/60.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems including substations.

Salary: N.J.B., Class F, Grade 11 (£710/£755).

Apply by letter to the Manager, Bedford District, Eastern Electricity Board, Prebend St, Bedford, by 29 Jan., 1960.

Northmet Sub-Area

SUB-AREA HEADQUARTERS
SOUTHGATE, N.14

ENGINEERING DRAUGHTSMEN (Ref. 831) 8/60.R.

Candidates should have had a good technical training and experience in the preparation of plans and detailed drawings of building and civil enginering works including substations, service centres, workshops, offices, etc.

Salary: N.J.B., Schedule G, Grade 6 (£620/£740) plus London Allowance.

Apply by letter to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet Hse, Southgate, London N.14, by 25 Jan., 1960.

Suffolk Sub-Area

CLACTON DISTRICT
DEMONSTRATOR 4/60.R.

Candidates should have had domestic science training including electrical housecraft; should preferably hold the E.A.W. Certificate and be competent to plan and give cookery demonstrations, including lectures, and advice to consumers on the use of domestic electrical appliances.

Salary: N.J.C., Grade 1 (£525/£625) although progress beyond £565 will be subject to a certificate that the person is capable of undertaking all the duties of the grade.

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Apply by letter to S. N. Boyne, A.M.I.E.E., Manager, Clacton District, Eastern Electricity Board, 56/58 Station Rd, Clacton-on-Sea, Essex, by 26 Feb., 1960.

Fens Sub-Area

MILTON HALL, MILTON, Nr. CAMBRIDGE
SUB-AREA COMMERCIAL OFFICER 10/60.R.

The duties of the appointment will be assisting the Sub-Area Manager in dealing with commercial matters affecting the application of tariffs to all classes of consumers and the overall commercial development of this mainly rural Sub-Area.

Great importance is attached to ensuring a high and uniform standard of consumer service and to the sale of appliances and the expansion of installation contracting departments. The successful candidate would, therefore, be expected to participate in a very active manner in co-ordinating and developing these aspects of commercial work throughout the Sub-Area.

Salary in accordance with Grade 5, Class B (£1,740/£1,940) of the National Joint Managerial and Higher Executive Grades Agreement.

Apply by letter to the Manager, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Nr. Cambridge, by 29 Jan., 1960. (N 588)

SOUTH EASTERN ELECTRICITY BOARD

SENIOR DEMONSTRATOR
FOLKESTONE AND ASHFORD DISTRICT

SALARY: £640 x £20—£700 per annum under N.J.C., Grade 2. Superannuable. Applicants should have diploma or certificate in Domestic Science, also E.A.W. Certificate. Duties include lecturing, demonstrating, advising consumers, training junior demonstrators and generally assisting in any of the district's showrooms. Applications, quoting ET and naming two referees, to District Manager, Seeboard, York Hse, Cheriton Gdns, Folkestone, by 27 Jan., 1960.

ASSISTANT DISTRICT ENGINEER
FOLKESTONE AND ASHFORD DISTRICT

Salary: £910/£955 per annum, N.J.B., Class F, Grade 7. Superannuable. Applicants, who should possess H.N.C. or equivalent, should have had responsible experience and practice in the planning, construction, operation and maintenance of underground and overhead distribution networks in both urban and rural areas. Applications, quoting ET and naming two referees, to District Manager, Seeboard, York Hse, Cheriton Gdns, Folkestone, by 27 Jan., 1960.

CARTOGRAPHIC DRAUGHTSMAN
CROYDON AND PURLEY DISTRICT

Salary: £525 x £20—£625 per annum plus London Allowance under N.J.C., Grade 1. Applicants must have sound experience in the preparation of mains records, network diagrams, site surveys and general drawing office duties. Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 27 Jan., 1960.

ENGINEERING DRAUGHTSMAN
CROYDON AND PURLEY DISTRICT

Salary: £660 x £20—£780 per annum including London Allowance under N.J.B., Schedule D, Grade 6. Superannuable. Applicants should be of good general and technical education and should have experience in the layout of switchgear and associated equipment for substations up to 11 kV. Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 27 Jan., 1960.

SENIOR DRAUGHTSMAN
CROYDON AND PURLEY DISTRICT

Salary: £830/£940 per annum including London Allowance under N.J.B., Schedule D, Grade 5. Superannuable. Applicants should be suitably qualified and capable of supervising a large district drawing office under the District Engineer. Experience in basic design, layout of substations up to 11 kV, presentation of data and mains and system records is essential. Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 27 Jan., 1960.

continued in next column

continued from previous column

ASSISTANT DISTRICT ENGINEER
DORKING AND EPSOM DISTRICT

Salary: £910/£955 per annum, N.J.B., Grade 7, Class F. Superannuable. Applicants, preferably Corporate Members of the I.E.E., should have had responsible experience and practice in the planning, construction and operation and maintenance of underground and overhead distribution networks in both urban and rural areas. Payment of a car allowance will be considered. Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, 56 South St, Dorking, by 27 Jan., 1960.

GEORGE WRAY,
Secretary.
(N 584)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

APPOINTMENT OF FOURTH ASSISTANT ENGINEER (TEST)

APPLICATIONS are invited for the above appointment. Applicants should possess the necessary technical qualifications and have had a sound engineering training. They should have had some experience in testing and commissioning modern protective equipment and should be conversant with voltage drop and short circuit calculations and H.V. fault location.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A, the present Classification and Grading being L.13, salary £860/£905 per annum. The post is superannuable.

The successful candidate will require to reside within a reasonable distance of the Transformer Test Department at Motherwell.

Application forms which may be obtained from the undersigned should be forwarded to this office within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Cres,
Hamilton. (N 587)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 3/ET/60.

APPLICATIONS invited for superannuable N.J.B. position of THIRD ASSISTANT ENGINEER (CIVIL) in the Transmission (Construction) Department, Divisional Headquarters.

Salary: AX/DX5 (£1,090/£1,320 per annum).

Applicants will be required to undertake duties concerned with the Civil Engineering and Building Construction by Contract of new high voltage Substations and Extensions in the South Wales Division for the Central Electricity Generating Board. Experience of contract procedures, reinforced concrete work and site supervision particularly necessary.

Candidates should preferably be Corporate Members of the Institution of Civil Engineers or have qualifications leading thereto.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 25 Jan., 1960. (N 578)

GOVERNMENT OF KENYA

ENGINEER (ELECTRICAL)
MINISTRY OF WORKS

TO design electrical installations in public institutions, airports and housing.

Contract appointment with prospects of permanency. Salary range: £1,194/£1,863. Gratuity. Free passages. Quarters when available at low rent.

Candidates, 26-45 years, must be A.M.I.E.E. or possess a University degree in electrical engineering and have relevant experience.

Write Director of Recruitment, Colonial Office, London S.W.1, giving full names, age, qualifications and experience, quoting BCD 112/7/027/D10. (N 539)

Ferranti

a vacancy has arisen in the

TRANSFORMER DEPARTMENT

for a

DESIGN ENGINEER

for work on control problems in relation to transformers and associated apparatus, including on-load tap change gear and high-voltage equipment.

Candidates should be under 30 years of age and possess a Higher National Certificate in Electrical Engineering.

The Company has a Pension Scheme and a Dependants' Insurance Scheme.

Application forms can be obtained from:

T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs.

Please quote ref.: TD. (N 563)

A SENIOR ELECTRICAL DRAUGHTSMAN required to participate in the planning and installation of a new plant involving H.V. and L.V. Switchgear, a.c. and d.c. motors, control gear and electronic equipment. Accommodation available. Applications stating age, qualifications, training and subsequent experience to: The Labour Manager, Barrow Steel Works Ltd., P.O. Box No. 16, Walney Rd, Barrow-in-Furness, Lancs. (N 543)

ELECTRICAL CONTRACTOR'S DRAUGHTSMAN with some experience of estimating required by Kuwait Associates. Salary: £1,000/£1,200 per annum. Free furnished accommodation. Cost of living allowance £37 10s per month. Single man preferred as no married accommodation available for first two years. Contract on yearly basis with option of renewal. Paid leave at rate of 36 days per annum on total overseas service if tour extended to second year. Applications, stating age and experience, to: Drake and Gorham (Contractors) Ltd., 36 Grosvenor Gardens, London S.W.1. (N 544)

PROVISIONAL APPROVALS BOARD FOR DOMESTIC ELECTRICAL APPLIANCES

DIRECTOR

Applications are invited for the post of DIRECTOR OF THE BOARD now being established to undertake the approval, on a National basis, of all domestic electrical appliances.

This is an important post requiring first class administrative ability and sound judgment.

A background of engineering experience, both technical and commercial is desirable.

Commencing salary will depend upon qualifications and experience but will not be less than £3,000, with provision for superannuation. Age not more than about 50 years.

Applications, in writing, which will be treated in strict confidence, to be sent, as soon as possible to:

The Chairman,
Provisional Approvals Board for Domestic Electrical Appliances,
61/62 Lincolns Inn Fields,
London, W.C.2,

(N 599)

CHECKERS AND SENIOR DRAUGHTSMEN are required for the design of complete electrical installations for Oil Refineries, Chemical Plants, and similar projects. Pension and life assurance scheme. Apply in writing stating age, qualifications, experience and salary required, to Foster Wheeler Ltd., 3 Ixworth Pl, London S.W.3. (N 600)

SUPERVISING ELECTRICAL ENGINEER

required for the London head office of a well-known electrical contracting organisation to handle contracts throughout the U.K.

It is essential that applicants have extensive experience in this field, preferably with a contracting company.

This is a senior position and applications will not be considered from Foremen and Chargehands.

Commencing salary up to **£1,750 p.a.**, according to experience.

Please write giving full details to Box No. 7639, Electrical Times. (N 519)

ELECTRICAL DESIGN DRAUGHTSMAN required to develop small drawing office, S.W. London. Partnership available to right person.—Box No. 7661, Electrical Times. (N 595)

TECHNICAL WRITER

for Publicity Department

to handle, in conjunction with Advertising Agents, literature for electrical and lighting products throughout all stages of production from planning to publication.

Applicants should have good technical writing background preferably with experience in the lighting and electrical field.

Excellent conditions of employment in impressive new London building with optional membership of good staff pension scheme. Applicants should include details of age, experience and salary required, to:

Advertising Manager,
ATLAS LIGHTING LIMITED,
Thorn House,
2/4 Upper St. Martin's Lane,
W.C.2

(N 579)

BRITISH Enka LIMITED

PRODUCERS OF MAN-MADE FIBRES

require

ASSISTANT TO CHIEF ELECTRICAL ENGINEER

for modern well-equipped plant. Experience of installation maintenance and operational work with continuous processes and of E.H.T. and M.V. systems necessary. Chemical experience an advantage. Ability to organise and handle labour essential. Minimum qualifications: Grad. I.E.E., preferably A.M.I.E.E.

Good salary and prospects. Pension scheme with facilities for transfer, assistance with housing.

Applications, in confidence, should state age, qualifications, experience in sequence and be addressed to Personnel Manager,

BRITISH ENKA LIMITED, AINTREE, LIVERPOOL

(N 576)

ELECTRICAL ENGINEER required for Head Office Staff. Degree or graduate membership of I.E.E. and practical training at manufacturer of electrical machines. Upper age limit 35. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., Longridge Hse, Manchester 4. (N 596)

EVERSHED AND VIGNOLES LTD. require YOUNG ENGINEERS of O.N.C. Electrical Engineering standard for their Instrument Division Contracts Department. Expanding opportunities for advancement. Write: Personnel Manager (ref. 115), Cunnington St, W.4. (N 597)

PHILIPS ELECTRICAL INDUSTRIES LIMITED

have vacancies for

ELECTRICAL DRAUGHTSMEN

in their

CENTRAL PLANT DEPARTMENT

at

CROYDON, SURREY

The work involves the design and lay-out of power and lighting installations for large factories and office blocks. Candidates should have electrical drawing office experience, and preferably have reached O.N.C. (Elect.) standard.

Commencing salaries will be according to age and experience, and the Company's conditions of employment include progressive pension, life assurance, holiday and sick pay schemes.

Applications, in writing, should be addressed to:

The Personnel Officer (4/ET),
Philips Electrical Industries Limited,
Waddon Hse, Stafford Rd,
Croydon, Surrey. (N 568)

THE ELECTRIC CONSTRUCTION COMPANY LIMITED

Applications invited for the position of

TOP LEVEL SALES DEVELOPMENT ENGINEER

for

SOUTHERN ENGLAND

Applicants should be electrical engineers, preferably Corporate Members of the I.E.E., with wide experience in the sale of electrical plant.

The Company manufacturers rotating matchines, switchgear, rectifiers and transformers, and experience in the sale of all these products would be an advantage.

A knowledge of the London Area and suitable connections with the engineering industry would be further advantages.

Applications in writing, giving details of training, sales connections, etc., to:

J. Johnson Smith, M.I.E.E.,
Director,
The Electric Construction Company Limited,
" Bushbury House ",
57 Buckingham Gate,
Westminster, London, S.W.1

(N 561)

EXPANDING British Company in Iran require a qualified INSTRUMENTATION ENGINEER for design office in Teheran. Must be experienced in industrial process automatic control, preferably as applied to the oil or chemical industries, boiler and turbine control and alarm systems Electronics experience would be an advantage. Minimum age 28. Salary according to age and experience with general local allowances. Two-year contracts. Full particulars to Box No. 7651, Electrical Times. (N 547)

ELECTRICIANS

Electricians required for general maintenance and installation work on large integrated Iron and Steel Works. Excellent conditions. Pension Scheme in operation. Apply to: **The Employment Officer, Appleby-Frodingham Steel Co., Scunthorpe, Lincs.**

(N 523)

PHILIPS ELECTRICAL LTD.

have a vacancy in London and the Home Counties for a man aged 25/35 as a

LIGHTING ENGINEER

The work demands a good illuminating engineering training (Dip. M.I.E.S. preferred but not essential), with a thorough knowledge of lamps and lighting equipment and circuits. Ability to deal with customers at all levels and discuss lighting problems is essential. The post is pensionable, conditions of employment are progressive, and a car is provided.

Please write with all details to the

Employment Officer,
Century Hse,
Shaftesbury Ave, W.C.2,

quoting ref. 323.

(N 569)

CABLE ENGINEER for A.E.I. Cable Division. An opportunity exists for a FULLY QUALIFIED ENGINEER to take control of development in the super tension cables and accessories department of the newly formed Cable Division. The post is London based and is permanent and pensionable. Salary will be in the region of £2,000 although a higher figure will be considered in the case of applicants possessing broad experience and a special aptitude for high voltage work in this field. Please write with full details to Staff Officer, Ref. 744/2/ET, Associated Electrical Industries (Woolwich), London S.E.18. (N 602)

EXPANDING British Company in Iran require a qualified TELECOMMUNICATIONS ENGINEER for design office in Teheran. Experience in the planning of Telephone Exchange Networks and Cable Distribution Schemes together with experience in VHF/UHF single- and multi-channel radio systems is essential. A knowledge of flameproof and intrinsically safe equipment should be an advantage. Minimum age 30. Salary according to age and experience with general local allowances. Two-year contracts. Full particulars to Box No. 7649, Electrical Times. (N 546)

ELECTRICAL CONTRACTS SUPERVISOR required for the Electrical Division of a large Building Contractor. Experienced in installations of Schools, Factories, Office Blocks. Capable of handling labour. Aged 35-45, good salary, pension scheme, other attractive conditions. State age, training and experience to Box No. 7657, Electrical Times. (N 559)

THE METALLIC SEAMLESS TUBE CO LTD.

JUNIOR SALES REPRESENTATIVE

required in London. The position is permanent and offers attractive future prospects. Knowledge of the Electrical Wholesale Industry essential. All applications, which will be treated in the strictest confidence, should give age and full details of previous experience, and should be addressed to the Manager, The Metallic Seamless Tube Co. Ltd., 88 Goswell Rd, London E.C.1.

(N 545)

ELECTRICAL ENGINEER required by London Consulting Engineers for preparation of design, specifications, etc., for schools, hospitals and commercial buildings. Write stating age, experience, qualifications and salary required to Box No. 7393, Electrical Times. (N 18)

ELECTRICAL Engineering Co. specialising in Automatic Contactor Gear, Crane Control Gear, Resistances and Control Panels, require first rate SALES REPRESENTATIVE. Technical knowledge preferred but not essential. Salary: £1,000/£1,500 per annum, plus expenses, to suitable applicant with worthwhile connections. Write giving full details of experience and present salary to Box No. 7655, Electrical Times. (N 549)

ENERGETIC SALES ENGINEER required for Midlands area to develop Sales of a wide range of M.V. Switchgear preparatory to establishing a Depot. Connections desirable with Consultants, Leading Contractors, Electricity Board and Industrial Users for Cubicles, Metalclad Switchboards, complete range of Fuse and Switchgear, Substation Boards, Feeder Pillars, Busbar Trunking. Please give full experience, present salary, etc., in confidence to: Managing Director, Messrs G. P. Dennis Ltd., Speke, Liverpool. (N 571)

PLUMBER JOINTERS, H.V. and L.V., required for Contracting work. Applicants should be willing to undertake a trade test. Box No. 7645, Electrical Times. (N 534)

REPRESENTATIVE required by lighting fitting manufacturers to cover contractors and wholesalers in London area. Generous car allowance and expenses, etc. Salary according to experience. Box No. 7653, Electrical Times. (N 548)

SALES ENGINEERS with established connections in the London, Birmingham and Leeds areas to represent a well established company manufacturing Motors and Electric Control Gear. Apply in confidence with full details to Box 7659, Electrical Times. (N 562)

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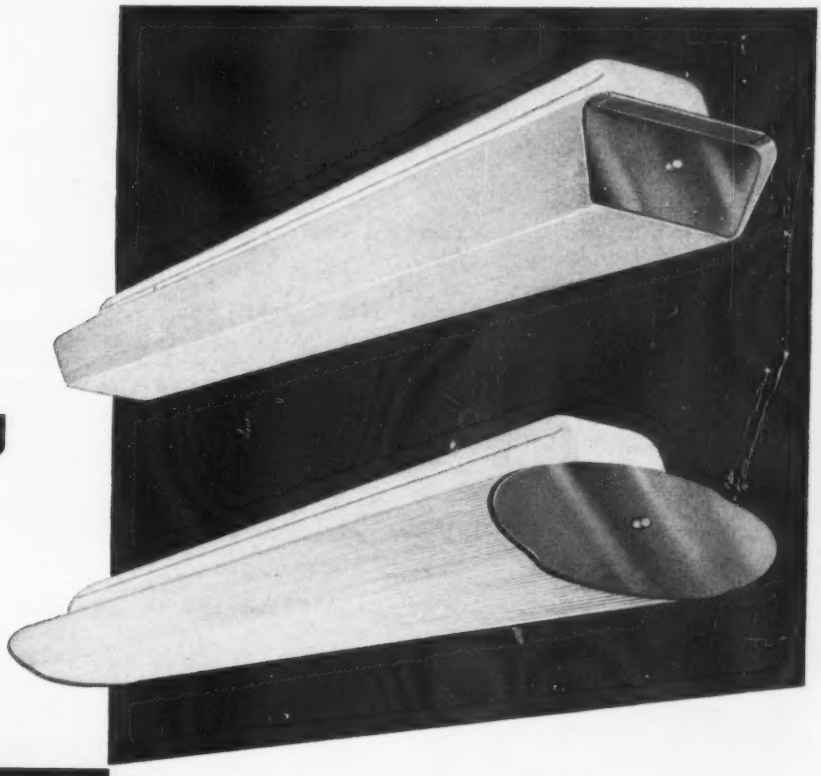

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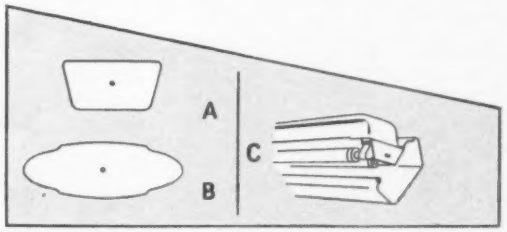

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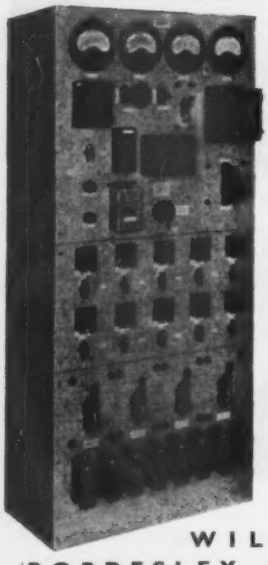

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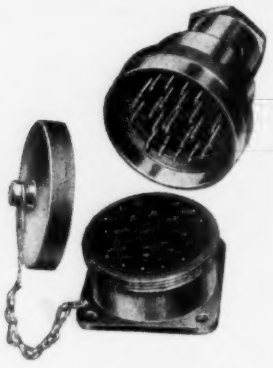

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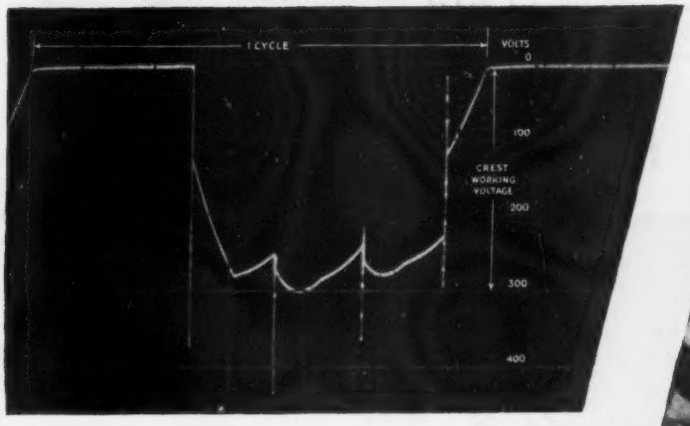

Associated Electrical Industries announce the development of germanium power rectifier cells which, with a current rating of 40 amperes and a voltage drop of 0.5 volt during the conducting period, are suitable for a crest working voltage of 300 volts.

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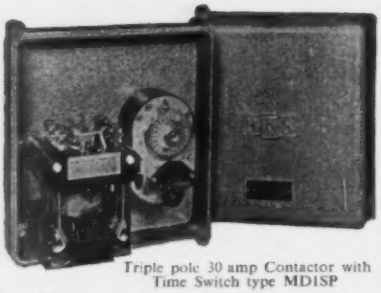

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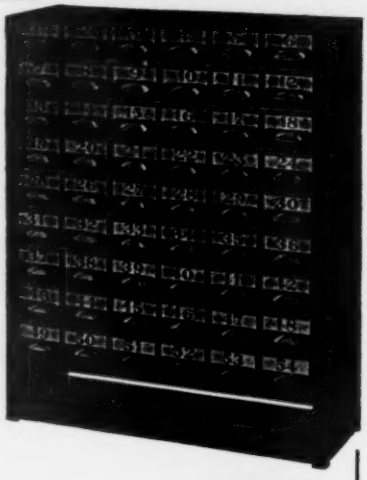

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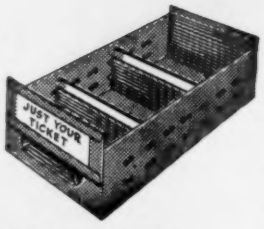

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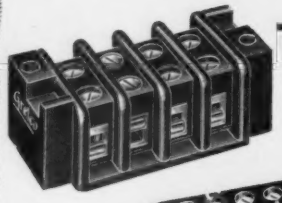

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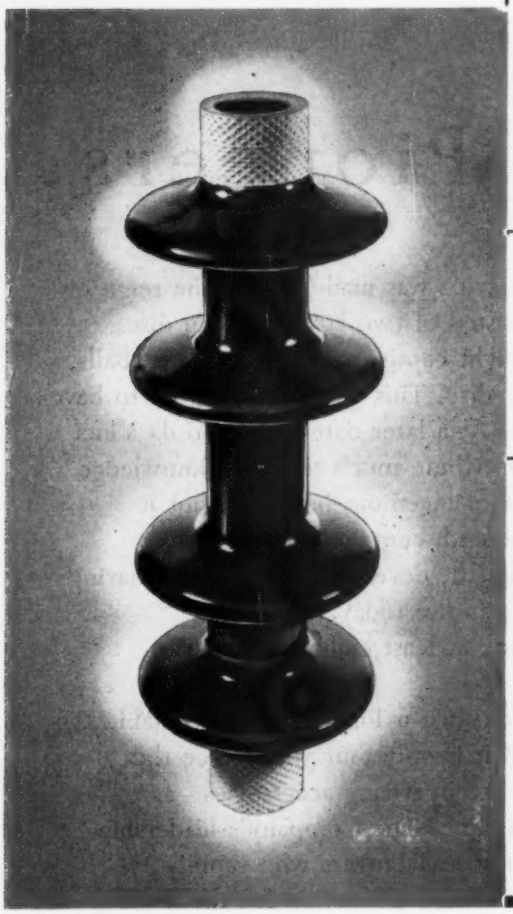

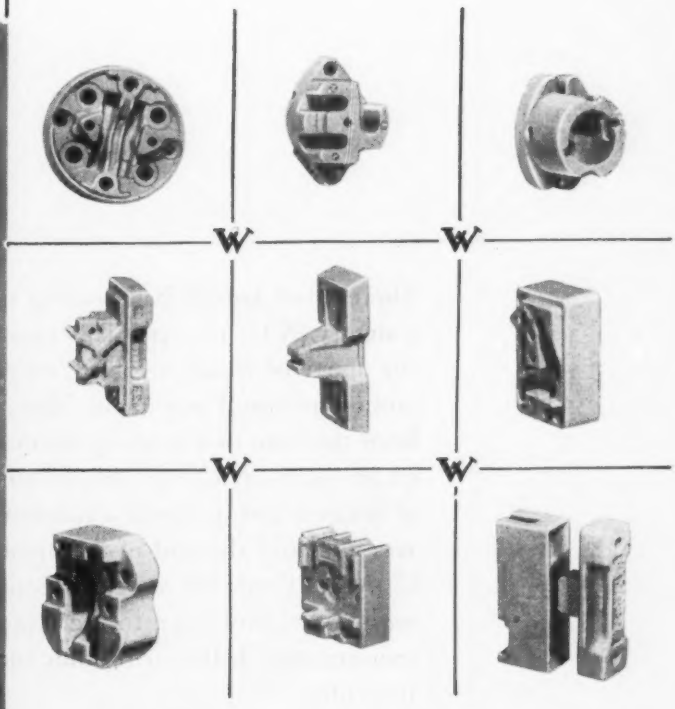

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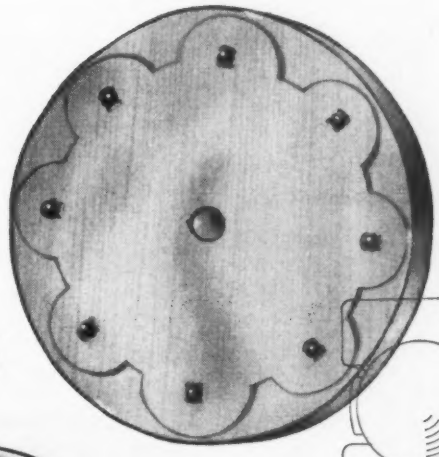
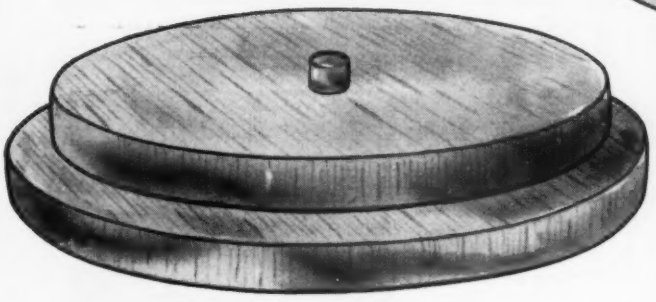
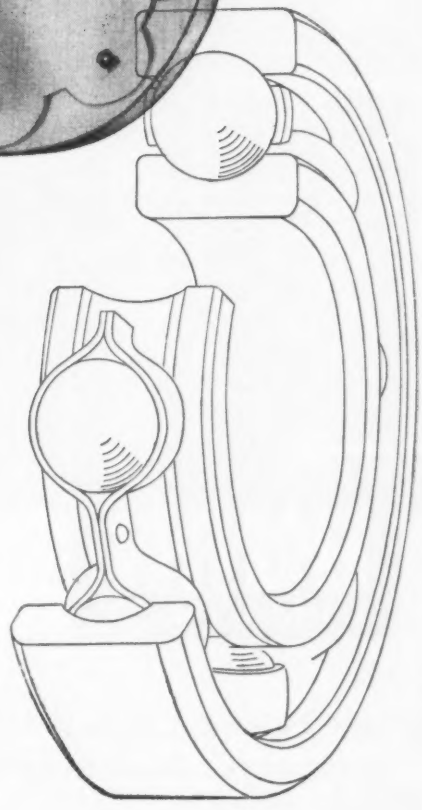
The Emperor Caligula
A.D.12-41



Artist's drawing of Roman ball bearing found in Lake Nemi





Cut-away drawing of modern (S.K.F.) ball race

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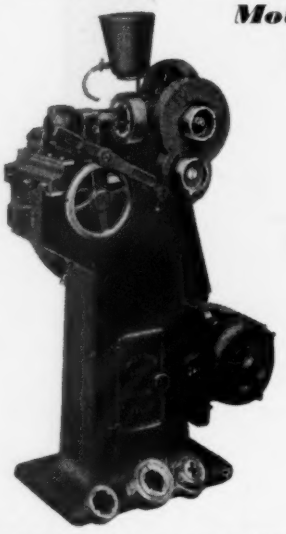

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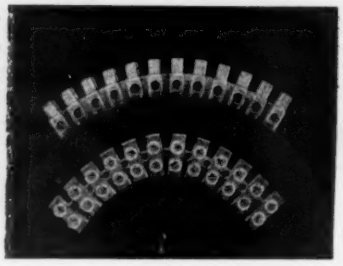

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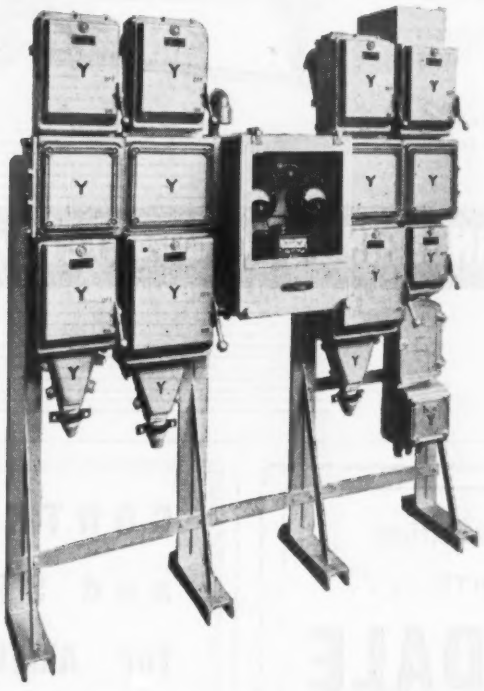

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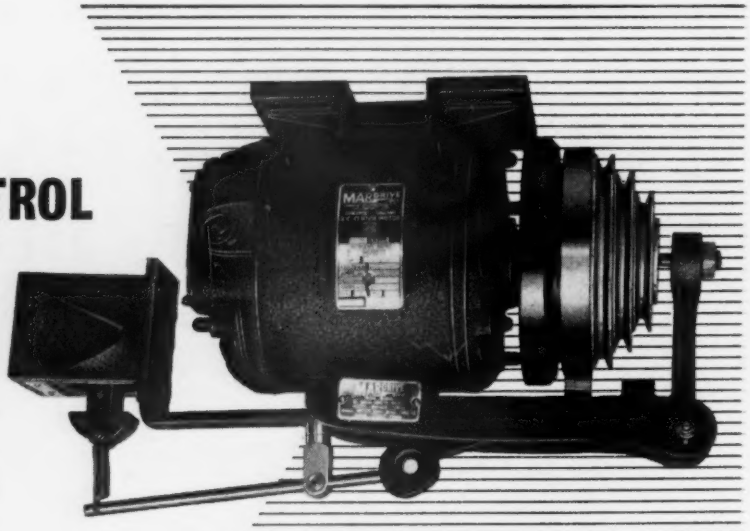

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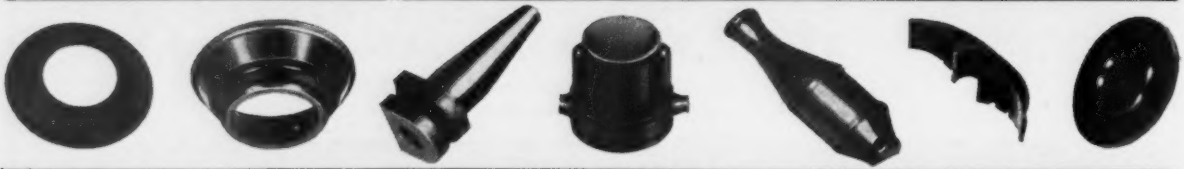

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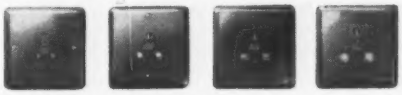
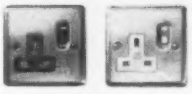


with brass plate finished BMA or matt chrome



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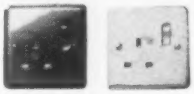
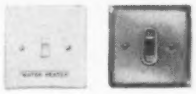


whether it's a fused spur-box

with a switch

or a pilot-lamp

a water-heater switch



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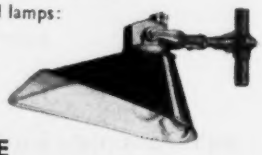

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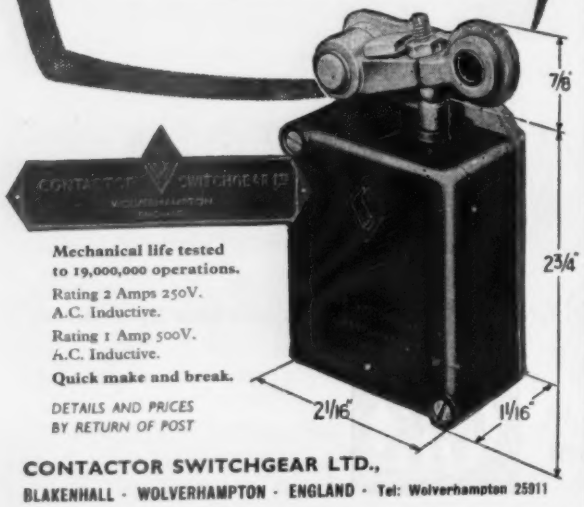

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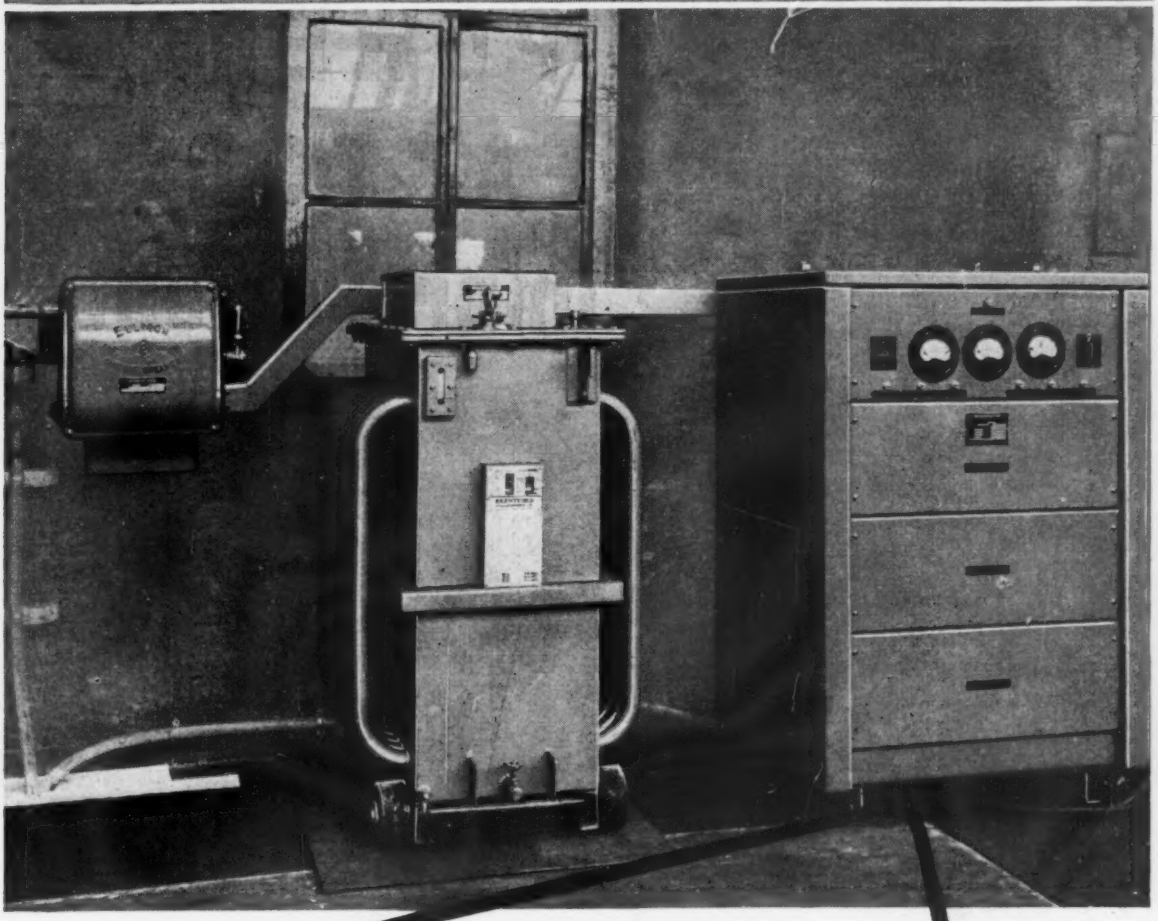

Another Rectifier installation by WESTINGHOUSE

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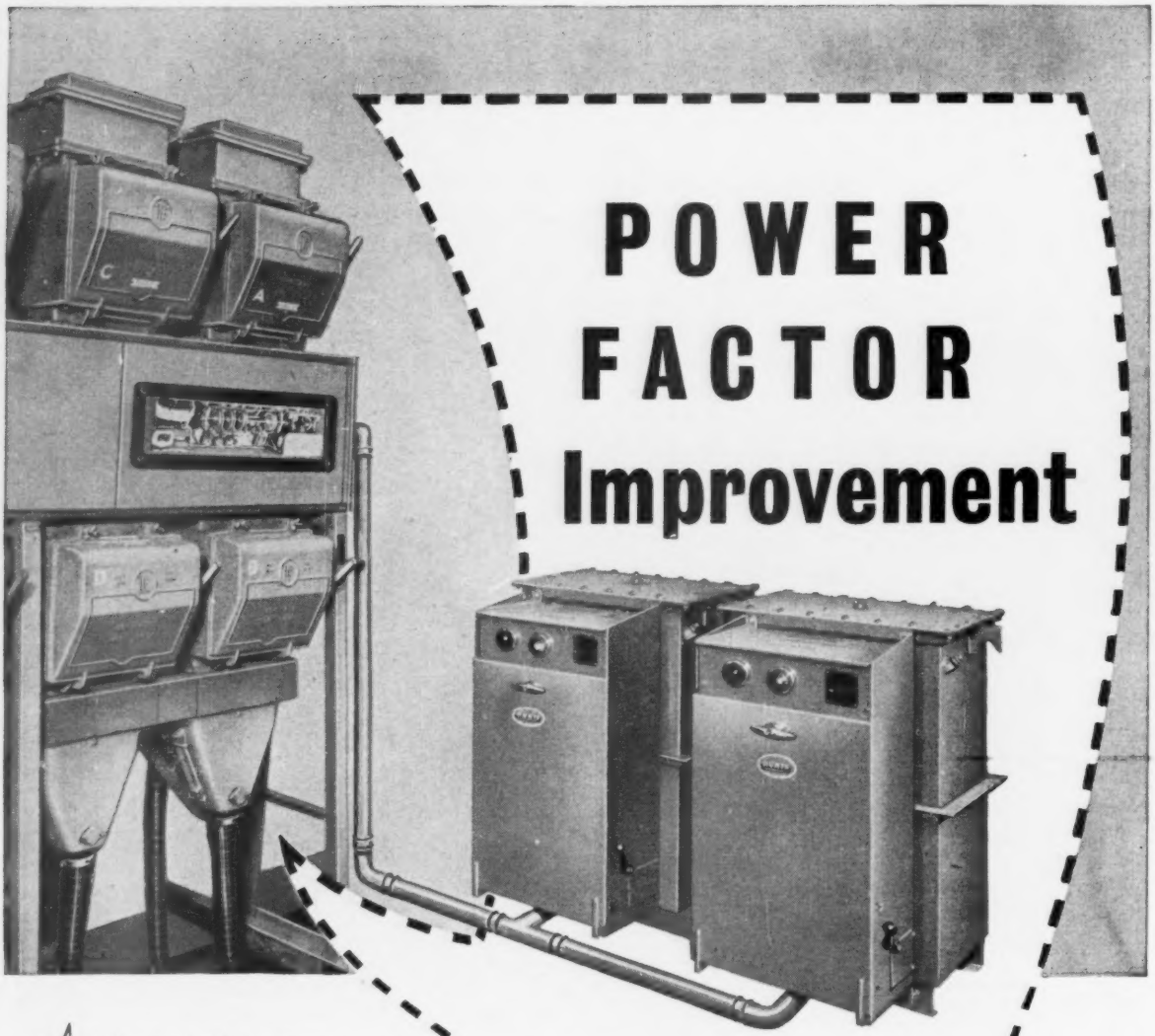

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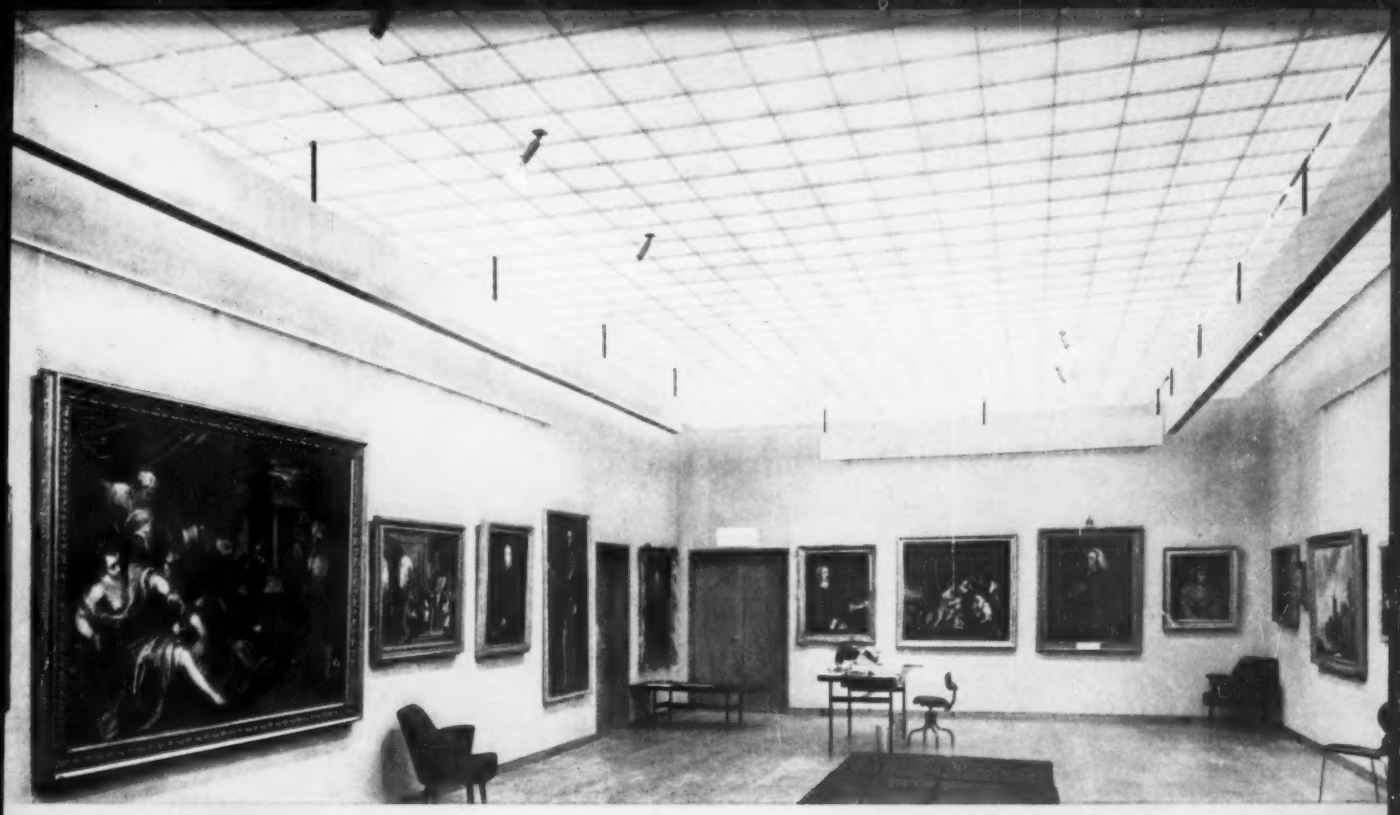

Lighting and Learning

New light on old masters. Modern lighting technique enhances the paintings in the main gallery of Fine Art at Nottingham University's new Portland building. A luminous ceiling combined with specially designed 5 ft. fluorescent picture light fittings with Osram warm white tubes. G.E.C. collaborated with the architects, Cecil Howitt & Partners, and Sir Hugh Casson, who was responsible for interior decoration, in creating lighting schemes for the whole of this building.

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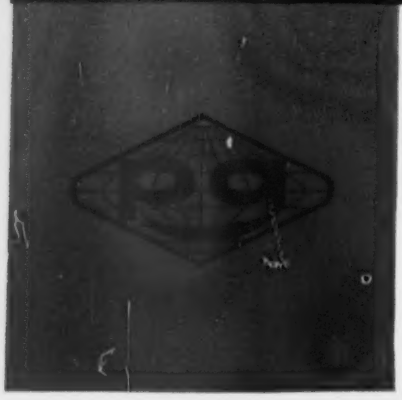
FIRST with 330kv

OIL-FILLED CABLES



proved a formidable undertaking, and the seven cables, all of which were installed in single lengths of 1,625ft. without intermediate joints, were carried on the bridge shown in the photograph. Pirelli-General are proud to announce that their contract to provide a vital link in this great Commonwealth enterprise has now been completed.

PIRELLI-GENERAL

CABLE WORKS LTD · SOUTHAMPTON